



**CHAMPAIGN COUNTY BOARD  
FACILITIES COMMITTEE AGENDA  
County of Champaign, Urbana, Illinois**

Tuesday, May 4, 2021 at 6:30  
Lyle Shields Meeting Room  
Brookens Administrative Center  
1776 E. Washington St., Urbana, IL 61802

**Committee Members:**

Steve Summers – Chair      Jenny Lokshin  
Stan Harper – Vice Chair      Emily Rodriguez  
Jim Goss                              Leah Taylor  
Jordan Humphrey                  Jodi Wolken

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• Being accepted remotely through zoom – for instructions go to: <a href="https://us02web.zoom.us/j/87603922493?pwd=WVBGeThlZ3h0cWRRQ2R3b1o2YjcvQT09">https://us02web.zoom.us/j/87603922493?pwd=WVBGeThlZ3h0cWRRQ2R3b1o2YjcvQT09</a>	
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E. Discussion and Approval of Lease Agreement with the Urbana Park District for Space at Brookens (Attached)	645-655

- F. Discussion of World War II Service Plaques recently refurbished and hung at Brookens (Attached) 656-660
  
- VII. Other Business
- VIII. Presiding Officer's Report
  - A. Future Meeting – **Tuesday, June 8, 2021 @ 6:30pm**
- IX. Designation of Items to be Placed on the Consent Agenda
- X. Adjournment

All meetings are at Brookens Administrative Center – 1776 E Washington Street in Urbana – unless otherwise noted. To enter Brookens after 4:30 p.m., enter at the north (rear) entrance located off Lierman Avenue.

Champaign County will generally, upon request, provide appropriate aids and services leading to effective communication for qualified persons with disabilities. Please contact Administrative Services, 217-384-3776, as soon as possible but no later than 48 hours before the scheduled meeting.



You are invited to a Zoom webinar.

When: May 4, 2021 06:30 PM Central Time (US and Canada)

Topic: Facilities Committee

Please click the link below to join the webinar:

<https://us02web.zoom.us/j/83285144488?pwd=bnErZ2VUUHkzRjdOM09qTkhvRXBiUT09>

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**CHAMPAIGN COUNTY BOARD  
FACILITIES COMMITTEE  
County of Champaign, Urbana, Illinois**

**MINUTES – Pending approval**

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**DATE:** Wednesday April 7, 2021  
**TIME:** 6:30 p.m.  
**PLACE:** Lyle Shields Meeting Room  
Brookens Administrative Center, 1776 E. Washington St., Urbana IL 61802  
(ZOOM Meeting)

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**Committee Members**

**Present:** Steve Summers, Stan Harper, Jodi Wolken, Jordan Humphrey, Emily Rodriguez, Leah Taylor, Jim Goss, Jenny Lokshin (All Committee Members participated via Zoom)

**Absent:** None.

**County Staff:** Dana Brenner (Facilities Director), Dan Busey (Recording Clerk), (County Staff physically present)

**Others Present:** Sheriff Heuerman, Captain Voges (Participated via Zoom)

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**Agenda**

**I. Call to Order and Roll Call**

Committee Chair Summers called the meeting to order at 6:30 P.M.

**II. Approval of Agenda/Addenda**

**Moved** by Mr. Goss to approve the agenda; seconded by Mr. Humphrey. Upon Roll Call Vote, the **Motion Carried Unanimously.**

**III. Approval of Minutes – March 2, 2021**

**Moved** by Mr. Harper to approve the Minutes from March 2, 2021; seconded by Ms. Taylor. **Upon Roll Call Vote, the Motion Carried Unanimously.**

**IV. Public Participation**

Ben Beaupre addressed the committee about the safety concerns of the current state of the Downtown Jail.

**V. Communications**

There were no communications brought before the committee.

**VI. New Business**

**A. Discussion of Champaign County Jail Issues.**

Sheriff Heuerman told the committee that they are experiencing some of the same issues that they have been experiencing for several years. COVID has brought to light even more concerns from the Sheriffs perspective. Mr. Brenner spoke about population numbers and problems with D.O.C. (Department of Corrections) not accepting prisoners that have been sentenced. Sheriff Heuerman spoke about housing and classification issues that the Downtown and Satellite Jails are currently facing. Mr. Brenner gave a brief run down of the upcoming HVAC replacement at the

Satellite Jail. Ms. Rodriguez asked about access to medical care in the Satellite Jail. The Sheriff discussed the protocols of Medical Treatment within the facility as well as transports from the jail to Medical Facilities. Ms. Rodriguez asked about withdrawal symptoms for detainees in the jail. Captain Voges spoke about the contracted Medical Staff and the protocols that are in place for detainees experiencing withdrawal symptoms. Ms. Rodriguez asked for differences in the handling of withdrawal symptoms in Champaign County as opposed to other counties. Captain Voges explained that there are protocols specific to the type of withdrawals detainees are having. A discussion about housing inmates out of county and within the Satellite and Downtown Jails ensued. Captain Voges spoke about the issues of detaining the Mentally Ill and the fact that they have been detained by Court Order creates issues within the facility. Ms. Rodriguez and Captain Voges had a conversation about the numbers of detainees and where they are in the Court Process. Captain Voges went on to speak more about housing issues due to the state of the Downtown Jail, as well as other factors such as COVID and inmate classifications. Mr. Summers expressed his hopes of more committee members touring both jails.

- B. Discussion and Approval of County Highway Maintenance Metal Roof Replacement and ILEAS Asphalt Shingle Replacement Bid Documents \*95% Complete.  
Mr. Brenner stated that Reifsteck Reid & Company Architects, Corp. put together a bid document that spells out the bidding. If approved the bid will go out on April 8<sup>th</sup> on the Reifsteck & Reid website as well as the counties website. Mr. Brenner spoke to the logistics of how the bids will be tracked and received. Substantial completion for the project should be by the end of December 2021. **Moved** by Ms. Taylor to approve County Highway Maintenance Metal Roof Replacement and ILEAS Asphalt Shingle Replacement Bid Documents; seconded by Ms. Lokshin. Upon Roll Call Vote, the **Motion Carried Unanimously**.
- C. Discussion of American Rescue Plan Act.  
Mr. Summers stated that part of the reason for the act is to address the issues of COVID, which would relate to overcrowding in the jail. Ms. Rodriguez stated that she would see no issue that would face more scrutiny than spending money on the jail. Mr. Humphrey spoke to his interests about what type of funding, specifically public/inmate safety, that the money would qualify for. Ms. Taylor mentioned adding on a smaller pod wing to the Satellite Jail that could be used during pandemics for distancing and medical needs. Ms. Taylor went on to say that if it were not a pandemic it could be used for other sorts of separation or medical needs. Mr. Summers went on to speak about the lack of ability to separate the population of the Satellite Jail for any reason. Mr. Harper weighted in on the need for housing separation within the Satellite Jail as well as the poor state of the Downtown Jail. Mr. Summers spoke to the fact that the county should not unnecessarily incarcerate anyone, however that it is also the County Boards responsibility to ensure safe and fair conditions to those who have been incarcerated. Ms. Rodriguez spoke to her concerns of the possible shifting population of the jail population due to the possibility of ending cash bail. Mr. Goss commented that the county may go away from cash bail but that does not get away from individuals awaiting felony cases. Mr. Goss also spoke to the fact the IDOC and DHS had issues taking inmates even before COVID.

D. Discussion of air quality study for RPC - Brookens POD #100.

Mr. Brenner pointed to the full report from OEHS Environmental and Occupational Health Solutions. This was regarding complaints from office workers of the Regional Planning Commission (RPC) of experiencing headaches etc. OEHS conducted extensive testing of the air quality of the area as well as the HVAC air handlers atop of the RPC Office area. The air quality was found to be very comparable to that of the outdoors, as the air is circulated from outside. A low concentration of yeast was detected. Mr. Brenner said that the air handlers will be cleaned this month and the level of yeast was not of particular concern. A degree of alcohol was picked up in the test, likely resulting in the increased use of hand sanitizer due to COVID. Mr. Brenner stated what the report did find was that this is an extremely dry space. Mr. Brenner plans to speak with RPC about adding additional humidifiers to remedy the humidity level. Mr. Brenner touched on past reports done for Brookens by OEHS and believes that there is a pretty good handle on what the air quality is in the building due to the consistency of their reports.

**VII. Other Business**

A. Semi-annual Review of CLOSED Session Minutes.

**Upon Roll Call Vote** the CLOSED Session Minutes were voted to remain closed **unanimously.**

**VIII. Presiding Officer's Report**

A. Future Meeting – **Tuesday, May 4, 2021 @ 6:30pm.**

**IX. Designation of Items to be Placed on the Consent Agenda**

None.

**X. Adjournment**

The meeting adjourned at 7:35 P.M.

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**HAIL DAMAGED HVAC REPLACEMENT PROJECT**

**AT**

**BROOKENS ADMINISTRATIVE CENTER  
1776 EAST WASHINGTON STREET  
URBANA, ILLINOIS**

**FOR**

**COUNTY OF CHAMPAIGN  
URBANA, ILLINOIS 61802**

**PROJECT MANUAL  
ITB #2021-004**

**May 5, 2021**

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May 5, 2021

BID: County of Champaign, Illinois  
Hail Damaged HVAC Replacement Project  
**Friday, June 4, 2021**  
**3:00 P.M., Public Opening**  
Lyle Shields Conference Room  
Brookens Administrative Center  
1776 East Washington  
Urbana, Illinois 61802-4581

Dear Bidder:

The County of Champaign is inviting the submission of sealed bids for the Hail Damaged HVAC Replacement Project at Brookens Administrative Center, 1776 East Washington, Urbana, IL 61802.

Specifications are prepared with the intent of offering equal opportunity to all bidders. No oral interpretations will be given to any bidder as to the meaning of the specifications. Requests for clarification must be submitted **in writing** via mail, fax or email to:

GHR Engineers and Associates, Inc.  
Attn.: Richard Van Note  
1615 South Neil Street  
Champaign, IL 61820  
Fax: (217) 356-1092  
Email: [rvannote@ghrinc.com](mailto:rvannote@ghrinc.com)

Clarification requests must be received no later than Wednesday, May 28, 2021, 12:00 pm noon to be considered.

Pursuant to the Illinois Prevailing Wage Act (820 ILCS 130/1 et seq.), not less than the prevailing rate of wages as determined by the Illinois Department of Labor, County of Champaign, or court on review shall be paid by the vendor/contractor to all laborers, workers and mechanics performing work under this purchase order.

All bids are to be sealed and in the hands of the undersigned by the due date and time stated above, at which time bids will be publicly opened. There will be no bids accepted after said date and time. Your bid is to be submitted on the bid form provided. The envelope containing your bid is to be sealed and marked in the lower left-hand corner: **“Sealed Bid: Hail Damaged HVAC Replacement Project”**. Bids will not be accepted by FAX mail.



The Champaign County Board reserves the right to reject any or all bids, to accept the bids, or to waive any irregularities should it deem to be in the best interest of the County of Champaign to do so. The bids will be awarded to the lowest responsible bidder meeting specifications as determined by the Champaign County Board.

Sincerely,

Dana Brenner  
Facilities Director

END OF NOTICE TO BIDDERS 00 0200

DOCUMENT 00 1116 - INVITATION TO BID - #2021-004

1.1 PROJECT INFORMATION

A. Notice to Bidders: Qualified bidders are invited to submit bids for Project as described in this Document.

B. Project Identification:  
**Hail Damaged HVAC Replacement Project**

1. Project Location:

Brookens Administrative Center  
1776 East Washington Street  
Urbana, IL 61802

C. Owner: County of Champaign

1. Owner's Representative:

**Dana Brenner, Facilities Director**  
1776 East Washington  
Urbana, IL 61802-4581  
Phone: (217) 384-3765  
Fax: (217) 384-3896  
Email: [dbrenner@co-champaign.il.us](mailto:dbrenner@co-champaign.il.us)

D. Project Design Team: GHR Engineers and Associates, Inc.

E. Project Description:

1. Base Bid: Project consists of replacement of hail damaged rooftop equipment at numerous Champaign County buildings.

F. Construction Contract: Bids will be received for the following Work:

Mechanical Contract.

## 1.2 BID SUBMITTAL AND OPENING

- A. Owner will receive sealed bids until the bid time and date at the location indicated below. Owner will consider bids prepared in compliance with the Contract Documents issued by Owner, and delivered as follows:
1. **Bid Date: Friday, June 4, 2021.**
  2. **Bid Time: 3:00 p.m., local time.**

Location:

**Lyle Shields Conference Room**  
**Brookens Administration Center**  
1776 East Washington  
Urbana, IL 61802

- B. Bids will be thereafter opened in the presence of the bidders and read aloud.

## 1.3 BID SECURITY

- A. Bid security in the form of a bank draft/cashier's check, certified check, U.S. money order, or bid bond **payable to County of Champaign** shall be submitted with each bid in the amount of **ten (10) percent** of the bid amount. No bids may be withdrawn for a period of **sixty (60) days** after opening of bids. Owner reserves the right to reject any and all bids and to waive informalities and irregularities.

## 1.4 PREBID CONFERENCE / SITE VISIT

- A. A prebid conference for all bidders will be held at **Lyle Shields Conference Room, Brookens Administration Center, 1776 East Washington, Urbana, Illinois** on Friday, May 21, 2021 at 3:00 pm, local time. Meet at front entrance.
- B. Building access for additional site visits may be made by contacting Owner's Representative.  
Dana Brenner, Facilities Director  
Phone: 217-384-3765  
Fax: 217-384-3896  
E-mail: [dbrenner@co-champaign.il.us](mailto:dbrenner@co-champaign.il.us)

## 1.5 DOCUMENTS

- A. Documents can be procured by emailing Shannon Hicks, [shicks@ghrinc.com](mailto:shicks@ghrinc.com). All documents will be in pdf form by email only.

## 1.6 TIME OF COMPLETION

- A. Bidders shall begin the Work on receipt of the Notice to Proceed and shall complete the Work within the Contract Time.
  1. Anticipated Award of Contract: Board Meeting, **Thursday, June 24, 2021.**
  2. Anticipated Letter of Notice of Award: On or about **Wednesday, July 2, 2021.**
  3. Pre-Construction/Pre-Installation Meeting: TBD.
  4. **Substantial Completion: Friday, November 12, 2021.**
  5. Punch List: Issued on or about **Tuesday, November 16, 2021.**
  6. **Final Completion: Tuesday, November 30, 2021.**

## 1.7 BIDDER'S QUALIFICATIONS

- A. Bidders must be properly licensed under the laws governing their respective trades and be able to obtain insurance and bonds required for the Work. **A Performance Bond, a separate Labor and Material Payment Bond, and Insurance in a form acceptable to Owner will be required of the successful Bidder.**

END OF DOCUMENT 00 1116

## DOCUMENT 00 2213 - SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

### 1.1 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS - BIDDER'S REPRESENTATIONS

- A. The Bidder has investigated all required fees, permits, and regulatory requirements of authorities having jurisdiction and has properly included in the submitted bid the cost of such fees, permits, and requirements not otherwise indicated as provided by Owner.
  - 1. Permit Application: Complete building permit application and file with authorities having jurisdiction within five days of the Notice of Ward.
- B. The Bidder is a properly licensed Contractor according to the laws and regulations of The State of Illinois and meets qualifications indicated in the Procurement and Contracting Documents.
- C. The Bidder has incorporated into the Bid adequate sums for work performed by installers whose qualifications meet those indicated in the Procurement and Contracting Documents.

### 1.2 BIDDING DOCUMENTS

- A. Interpretation or Correction of Procurement and Contracting Documents:
  - 1. Submit Bidder's Requests for Interpretation as outlined in the Notice to Bidders.
- B. Submit Requests for Substitution on form provided. Substitution requests shall be in advance of bid.
- C. Addenda:
  - 1. Addenda may be issued at any time prior to the receipt of bids.
  - 2. Owner may elect to waive the requirement for acknowledging receipt of Addenda as follows:
    - a. Information received as part of the Bid indicates that the Bid, as submitted, reflects modifications to the Procurement and Contracting Documents included in an unacknowledged Addendum.

- b. Modifications to the Procurement and Contracting Documents in an unacknowledged Addendum do not, in the opinion of Owner, affect the Contract Sum or Contract Time.

### 1.3 BIDDING PROCEDURES

#### A. Preparation of Bids:

1. The Bid shall include unit prices when called for by the Procurement and Contracting Documents. Owner may elect to consider unit prices in the determination of award. Unit prices will be incorporated into the Contract.
2. Owner may elect to disqualify a bid due to failure to submit a bid in the form requested, failure to bid requested alternates or unit prices, failure to complete entries in all blanks in the Bid Form, or inclusion by the Bidder of any alternates, conditions, limitations or provisions not called for.

**Retail sales tax will NOT be included in the bid amount.** The Owner is exempted by Section 3 of the Illinois Use Tax Act (Section 3, House Bill 1610, approved July 31, 1961, Illinois Revised Statutes 1967, Chapter 120, Section 439.3) from paying any of the taxes imposed by the Act and sales to Owner are exempt by Section 2, House Bill 1609, approved July 31, 1961, Illinois Revised statutes 1967, Chapter 120, Section 441) from any of the taxes imposed by the Act. The Department of Revenue of the State of Illinois under Rule No. 15, issued August 9, 1961, has declared that sales of materials to construction contractors for conversion into real estate for schools, governmental bodies, agencies and instrumentalities are not taxable retail sales. **The Contractor shall be responsible for any sales, consumer, use and similar taxes for the Work.**

3. Owner is not responsible for any costs incurred by a Contractor in the preparation or delivery of bids. The Contractor shall be responsible for the actual delivery of bids during business hours to the address indicated. Any bid received after the delivery deadline will be disqualified.
4. Owner reserves the right to obtain clarification of any point in a Contractor submittal or to obtain additional information.

FOIA: As an independent Contractor of the District, records in the possession of the Contractor related to this Agreement may be subject to the Illinois Freedom of Information Act ("FOIA"), 5 ILCS 140/5-1 et seq.; 5 ILCS 140/7(2). The Contractor shall immediately provide the District with any such records

requested by the District in order to timely respond to any FOIA request received by the District.

B. Subcontractors, Suppliers, and Manufacturers List Bid Supplement:

1. Provide list of major subcontractors, suppliers, and manufacturers furnishing or installing products no later than **ten (10) business days** following Notice to Proceed. Do not change subcontractors, suppliers, and manufacturers from those submitted without approval of Owner.

1.4 CONSIDERATION OF BIDS

A. Rejection of Bids:

Owner reserves the right to reject a bid based on Owner's and Design Team's evaluation of qualification information submitted following opening of bids. Owner's evaluation of the Bidder's qualifications will include: status of licensure and record of compliance with licensing requirements, record of quality of completed work, record of Project completion and ability to complete, record of financial management including financial resources available to complete Project and record of timely payment of obligations, record of Project site management including compliance with requirements of authorities having jurisdiction, record of and number of current claims and disputes and the status of their resolution, and qualifications of the Bidder's proposed Project staff and proposed subcontractors.

1.5 PERFORMANCE BOND AND PAYMENT BOND

- A. Both a Performance Bond and a Payment Bond will be required, each in an amount equal to 100 percent of the Contract Sum.
- B. The Bidder shall deliver the required bonds to Owner no later than **ten (10)** days after the date of Notice of Intent to Award and no later than the date of execution of the Contract, whichever occurs first. Owner may deem the failure of the Bidder to deliver required bonds within the period of time allowed a default.
- C. Bonds shall be executed and be in force on the date of the execution of the Contract.

## 1.6 INSURANCE

- A. The Contractor shall take all necessary precautions and exercise due caution so as not to damage the premises or properties of others. The Contractor's signature on the bid sheet certifies to the District that the Contractor has adequate insurance coverage for any vehicle that may be utilized in the delivery of products or materials on the District's property. The Contractor shall submit evidence, satisfactory to the District, that the Contractor has coverage of General Liability Insurance, Worker's Compensation Insurance, and Automobile Liability Insurance to the limits described below with companies licensed to do business in Illinois with an A.M. Best rating of A that is satisfactory to the District. The certificates of such insurance shall carry an endorsement to the effect that the Insurance Company will defend the District as a party in the event the successful bidder becomes a party to any litigation as a result of the activities of the Contractor, subcontractor, or any direct or indirect employee of same under the terms of this contract for injuries to property or person. Such policies shall name the District, its Board, Board members, employees, agents, and successors as an additional insured and provide that it is primary to, and not contributing with, any policy carried by Contractor covering the same loss with a waiver of subrogation in favor of the School District. The Contractor shall provide Certificates of Insurance for:
1. Vehicular: It is required that the successful Contractor present to the District, before commencing delivery under this Contract, a Certificate of Insurance covering all vehicles that may be utilized. Said insurance is to provide a \$1,000,000 combined single limit for bodily injury and property damage. All certificates shall indicate that the carrying company shall not cancel insurance coverage without giving Owner thirty (30) days written advance notification.
  2. Liability: It is required that the successful Contractor present to the District, **before commencing delivery under this Contract**, a Certificate of Insurance for which coverage is included for contractor liability, contingent liability, contractual liability, and product liability. Bodily injury and property damage limits of \$1,000,000 occurrence and \$2,000,000 aggregate. Said Certificate shall indicate that the carrying company shall not cancel insurance coverage without giving District thirty (30) days written advance notice.
  3. Worker's Compensation: Statutory Limits.

## 1.7 STANDARD CONTRACT CONDITIONS

- A. This contract shall be governed in all aspects as to validity, construction, capacity, performance, or otherwise by the laws of the State of Illinois.



- B. Contractors shall comply with the Civil Rights Act of 1964, as amended, all applicable State and Federal non-discrimination laws including but not limited to the Family and Medical Leave Act, the Americans with Disabilities Act, the Age Discrimination in Employment Act and shall comply with the provisions of the Illinois Human Rights Act.
- C. Contractors shall not assign, transfer, convey, sublet, or otherwise dispose of this contract, including any or all of it right, title or interest therein, or its power to execute such contract to any person, company or corporation, without prior written consent of The County of Champaign.
- D. By submitting a bid the Contractor certifies that the Contractor is not barred from bidding on this contract as a result of a violation of either the bid-rigging or bid-rotating provisions of Article 33E of the Criminal Code of 1961, as amended.

By submitting a bid, the Contractor, having 25 or more employees, does hereby certify pursuant to Section 3 of the Illinois Drug-Free Workplace Act (30 ILCS 580/3) that it shall provide a drug-free workplace for all employees engaged in the performance of work under the contract by complying with the requirements of the Illinois Drug-Free Workplace Act and, further certifies, that it is not ineligible for award of this contract by reason of debarment for a violation of the Illinois Drug-Free Workplace Act.

- E. By submitting a bid, the Contractor does hereby certify pursuant to Section 2-105 of the Illinois Human Rights Act (775 ILCS 5/2-105) that it has a written sexual harassment policy that includes, at a minimum, the following information: (i) the illegality of sexual harassment; (ii) the definition of sexual harassment under State law; (iii) a description of sexual harassment, utilizing examples; (iv) an internal complaint process including penalties; (v) the legal recourse, investigative and complaint process available through the Department of Human Rights and Human Rights Commission; (vi) direction on how to contact the Department of Human Rights and Human Rights Commission; and (vii) protection against retaliation.

## 1.8 STATEMENT OF NON-DISCRIMINATION

- A. The Illinois Human Rights Acts prohibits discrimination on the basis of: “race, color, religion, sex, national origin, ancestry, age, order of protection status, marital status, physical or mental disability, military status, sexual orientation, or unfavorable discharge from military service in connection with employment, real estate transactions, access to financial credit, and the availability of public accommodations.” It also prohibits sexual harassment and discrimination in employment on the basis of citizenship status.

## 1.9 PREVAILING WAGE

- A. This contract calls for the construction of a “public work” within the meaning of the Illinois Prevailing Wage Act, 920 ILCS 130/.01. The Act requires contractors and subcontractors to pay al laborers, workers and mechanics performing services on public works projects no less than the “prevailing rate of wages” (hourly cash wages plus fringe benefits) in the county where the work is performed. Each Contractor and Subcontractor rendering services under this contract must comply with all requirements of this Act. Each Contractor and Subcontractor shall keep records of the prevailing wages paid to their employees, submit a monthly certified payroll to County of Champaign, and make such records available to County of Champaign for inspection upon seven business days notice.
- B. For information regarding the current prevailing wage rates for Champaign County, Illinois can be found at:  
  
<http://www.illinois.gov/idol/laws-rules/conmed/pages/rates.aspx>.
- C. Prevailing Wage Rates change periodically. Contractor shall verify and revise the prevailing wages on a regular basis.

## 1.10 FAILURE TO FULFILL CONTRACT

- A. When any Contractor fails to provide a service or provides a service which does not conform to the specifications, County of Champaign may, at its sole discretion, annul and set aside the contract entered into with said Contractor, either in whole or in part, and make and enter into a new contract for the same services in such manner as seems to County of Champaign to be to its best advantage. Any failure to furnish services by reason of the failure of the Contractor, as stated above, shall be a liability against such Contractor and his sureties. County of Champaign reserves the right to cancel, without penalty, any services which the successful Contractor may be unable to furnish because of economic conditions, governmental regulations or other similar causes beyond the control of the Contractor provided satisfactory proof is furnished to County of Champaign if requested.
- B. Without Cause Termination: The County may terminate its contract with the Contractor without cause after providing the Contractor with thirty (30) days written notice.

#### 1.11 EXECUTION OF THE CONTRACT

- A. Subsequent to the Notice of Intent to Award, and within **ten (10) business days** after the prescribed Form of Agreement is presented to the Awardee for signature, the Awardee shall execute and deliver the Agreement to Owner through Architect, in such number of counterparts as Owner may require.
- B. Owner may deem as a default the failure of the Awardee to execute the Contract and to supply the required bonds and insurance when the Agreement is presented for signature within the period of time allowed.
- C. Unless otherwise indicated in the Procurement and Contracting Documents of the executed Agreement, the date of commencement of the Work shall be the date of the executed Agreement.  
In the event of a default, Owner may declare the amount of the Bid security forfeited and elect to either award the Contract to the next responsible bidder or re-advertise for bids.

#### 1.12 INDEMNITY

- A. To the fullest extent permitted by law, Contractor shall indemnify and hold harmless the Owner from and against claims, damages, losses and expenses, including but not limited to attorney's fees, arising out of or resulting from performance of the work provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property, but only to the extent caused by the negligent acts or omissions of the Contractor, a subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim damage, loss or expense is caused in part by a party indemnified hereunder.

END OF DOCUMENT 00 2213

## DOCUMENT 00 3119 - EXISTING CONDITION INFORMATION

### 1.1 EXISTING CONDITION INFORMATION

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of the Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.
  
- B. Photographic report of existing conditions that includes photographic documentation on existing conditions is appended to this Document.

END OF DOCUMENT 00 3119

DOCUMENT 00 4113 - BID FORM - STIPULATED SUM (SINGLE-PRIME CONTRACT)

1.1 BID INFORMATION

- A. Bidder: \_\_\_\_\_.
- B. Project Name: **Hail Damaged HVAC Replacement Project**
- C. Project Location:   Brookens Administrative Center  
                                  1776 East Washington Street  
                                  Urbana, Illinois 61802
- D. Owner: County of Champaign
- E. Building Design Team: GHR Engineers and Associates, Inc.

1.2 CERTIFICATIONS AND BASE BID

- A. Base Bid, Single-Prime (All Trades) Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by the Design Team, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

1. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).

**Bidders Note: Show bid amount in both words and figures. All spaces must be completed.**

1.3 BID GUARANTEE

- A. The undersigned Bidder agrees to execute a contract for this Work in the above amount and to furnish surety as specified within **ten (10)** days after a written Notice of Award, if offered within **sixty (60)** days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached bank draft/cashier's check, certified check, U.S. money order, or bid bond **payable to County of Champaign**, as liquidated damages for such failure, in an amount constituting **ten percent (10%)** of the Base Bid amount:

1. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).

- B. In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the bank draft/cashier's check, certified check, U.S. money order, or bid bond.
- C. The Owner reserves the right to accept or not accept Alternate Bids 1 and 2 in whatever order best serves the County's needs.

1.4 TIME OF COMPLETION

- A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Owner, and shall fully complete the Work as indicated in the Invitation to Bid.

1.5 ACKNOWLEDGEMENT OF ADDENDA

- A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:
  - 1. Addendum No. 1, dated \_\_\_\_\_.
  - 2. Addendum No. 2, dated \_\_\_\_\_.
  - 3. Addendum No. 3, dated \_\_\_\_\_.

1.6 CONTRACTOR'S LICENSE

- A. The undersigned warrants that he/she is duly authorized to bind contractually the entity submitting this bid, to fully perform all duties and to deliver all services in accordance with the terms and conditions set forth herein. All signatures to be sworn before a Notary Public.

1.7 SUBMISSION OF BID

Respectfully submitted this \_\_\_\_ day of \_\_\_\_\_, 2021.

Submitted By: \_\_\_\_\_  
(Name of bidding firm or corporation)

Authorized  
Signature: \_\_\_\_\_  
(Handwritten signature)

Signed By: \_\_\_\_\_  
(Type or print name)

Title: \_\_\_\_\_  
(Owner/Partner/President/Vice President)

Witness By: \_\_\_\_\_  
(Handwritten signature)

Attest: \_\_\_\_\_  
(Handwritten signature)

By: \_\_\_\_\_  
(Type or print name)

Subscribed and sworn to before me this  
\_\_\_\_\_ Day of \_\_\_\_\_, 2021.

\_\_\_\_\_, Notary Public

(Affix Notary Seal Here)

## DOCUMENT 00 4313 - BID SECURITY FORMS

### 1.1 BID FORM SUPPLEMENT

- A. A completed bid bond form is required to be attached to the Bid Form.

### 1.2 BID BOND FORM

- A. AIA Document A310, "Bid Bond," is the recommended form for a bid bond. A bid bond acceptable to Owner, is required to be attached to the Bid Form as a supplement.
- B. Copies of AIA standard forms may be obtained from The American Institute of Architects; [www.aia.org/contractdocs/purchase/index.htm](http://www.aia.org/contractdocs/purchase/index.htm); email: [docspurchases@aia.org](mailto:docspurchases@aia.org); (800) 942-7732.

END OF DOCUMENT 00 4313



## SECTION 01 1000 - SUMMARY

### PART 1 - GENERAL

#### 1.1 PROJECT INFORMATION

A. Project Identification: **Hail Damaged HVAC Replacement Project**

1. Project Location:

Brookens Administrative Center  
1776 East Washington Street  
Urbana, Illinois 61802

B. Owner: County of Champaign

C. Design Team: GHR Engineers and Associates, Inc.

D. Project Description:

1. Base Bid: Project consists of replacement of hail damaged rooftop equipment at numerous Champaign County buildings.

#### 1.2 WORK RESTRICTIONS

Contractor's Use of Premises: During construction, Contractor will have limited use of site and building indicated. Contractor's use of premises is limited only by Owner's right to perform work or employ other contractors on portions of Project and as follows:

1. Owner will occupy premises during construction. Perform construction only during normal working hours 8 AM to 5 PM Monday thru Friday, other than holidays, unless otherwise agreed to in advance by Owner. Clean up work areas and return to usable condition at the end of each work period.
2. Limits: Limit site disturbance.
3. Driveways, Walkways, and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 8 AM to 5 PM, Monday through Friday, unless otherwise indicated.
  - 1. Weekend Hours: As permitted by Owner. Coordinate with Owner.
  - 2. Early Morning Hours: 7 AM or as permitted by Owner. Coordinate with Owner.
- C. Nonsmoking Building: Smoking is not permitted within the building or on the project site.

### 1.3 BACKGROUND CHECKS

- A. All workers to work within the building will be required to have a background check. Checks will be performed by the Sheriff's Office. No fee to the contractor.

### 1.4 MISC

- A. Contractor to keep job site cleaned of loose debris.
- B. Contractor tools and equipment to be secured nightly.
- C. Protect roof & repair damage as needed.
- D. Protect fire-safing during work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 1000

## SECTION 01 2000 - PRICE AND PAYMENT PROCEDURES

### PART 1 - GENERAL

#### 1.1 PAYMENT PROCEDURES

- A. Submit a Schedule of Values at least **seven (7)** days before the initial Application for Payment. Break down the Contract Sum into at least one line item for each Specification Section in the Project Manual table of contents. Coordinate the schedule of values with Contractor's construction schedule.
1. Arrange schedule of values consistent with format of AIA Document G703.
  2. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
  3. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
  4. Provide separate line items in the schedule of values for initial cost of materials and for total installed value of that part of the Work.
  5. Provide a separate line item in the schedule of values for each allowance.
- B. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 forms for Applications for Payment.
1. Anticipated Application for Payment Schedule:
    - a. Application for Payment No. 01: once material is delivered to project site
    - b. Application for Payment No. 02: upon completion of installation
    - c. Application for Payment No. 03: Final payment upon completion of punch list, receipt of all close-out documents and completion of owner training
- C. Submit **three (3)** copies of each application for payment according to the schedule established in Owner/Contractor Agreement.
1. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor.
  2. With each Application for Payment, Contractor shall include the Contractor's waiver of lien for the full amount and partial waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

3. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
  - a. Include insurance certificates, proof that taxes, fees, and similar obligations were paid, and evidence that claims have been settled.
  - b. Include affidavit of payment of debts and claims on AIA Document G706.
  - c. Include affidavit of release of liens on AIA Document G706A.
  - d. Include consent of surety to final payment on AIA Document G707.
  
4. Certified Payroll Statements: The Contractor shall submit Certified Payroll Statements pursuant to Illinois Law-Public Act 94-0515 with each payment application. The *Certified Transcript of Payroll* statement forms are available through the Illinois Department of Labor website:  
<http://www.state.il.us/agency/idol/forms/pdfs/IL452CM02.pdf>.  
Certified payroll statements are required from the Contractor and each Subcontractor. The statements are to include the time period of the payment application. Payment Applications will not be processed without accompanying Certified Payroll Statements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2000

## SECTION 01 2500 - SUBSTITUTION PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUBSTITUTION PROCEDURES

- A. Substitutions include changes in products, materials, equipment, and methods of Contractor.
- B. Substitution Requests: Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles. Substitutions will NOT be considered after bidding.
  - 1. Substitution Request Form: Use facsimile of form provided in the Project Manual.
  - 2. **Submit requests by noon on Friday, May 28, 2021.**
  - 3. Identify product to be replaced and show compliance with requirements for substitutions. **Include a detailed comparison of significant qualities of proposed substitution with those of the Work specified**, a list of changes needed to other parts of the Work required to accommodate proposed substitution, and any proposed changes in the Contract Sum or the Contract Time should the substitution be accepted.
  - 4. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. **Indicate deviations, if any, from the Work specified.**
    - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

- e. Samples, where applicable or requested:
    - 1) All samples shall be clearly labeled with product information and Vendor contact information.
  - f. Certificates and qualification data, where applicable or requested.
  - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
  - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
  - i. Research reports evidencing compliance with building code in effect for Project.
  - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - k. Cost information, including a proposal of change, if any, in the Contract Sum.
  - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
  - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
- C. Architect will review proposed substitutions and notify Contractor of their acceptance or rejection via Addendum. If necessary, Architect will request additional information or documentation for evaluation.
- 1. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.
- D. Do not submit unapproved substitutions on Shop Drawings or other submittals.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2500

# SUBSTITUTION REQUEST FORM

**Project:** Hail Damaged HVAC Replacement Project

**Request No.:**

**Date:**

**Location (provide room number(s):**

**Name of Material, Product or Equipment item specified:**

**Name of Material, Product or Equipment item submitted as substitution:**

**Specification Section:**

**Qualities that differ from specified product or system:**

**Name of Manufacturer / Fabricator:**

**Address**

**City, State and Zip**

**Phone:**

Name of Vendor / Supplier Requesting Change	Address	Contact Name	Phone:

**Reason for requesting substitution request:**

**Substitution affects other materials or systems, such as dimensional revisions, redesign of structure or modifications to other work:**

\_\_\_\_\_ NO

\_\_\_\_\_ YES; describe requirements:



**If substitution requires modifications to dimensions indicated on drawings, are such modifications clearly indicated on attached data?**

\_\_\_\_\_ YES

\_\_\_\_\_ NO; if NO, explain:

**Substitution has an affect on Construction Schedule:**

\_\_\_\_\_ NO

\_\_\_\_\_ YES; describe affect on schedule:

**Savings or Credit to Contract Amount for accepting substitute:**

\_\_\_\_\_ Dollars (\$ \_\_\_\_\_).

Note: Show bid amount in both words and figures.

**The attached data is furnished herewith for evaluation of the substitution:**

\_\_\_\_\_ Product Data \_\_\_\_\_ Drawings \_\_\_\_\_ Samples \_\_\_\_\_ Tests \_\_\_\_\_ Reports

\_\_\_\_\_ Other Information; describe:

**The undersigned hereby certifies:**

1. The proposed substitution has been fully investigated and is equal or superior to specified product.
2. The same or better warranty will be furnished for proposed substitution as for specified material, product or equipment.
3. All changes in the work resulting from the use of this substitution, if approved, will be coordinated and completed in all respects and all costs, including, but not limited to, those for additional services rendered by the Owner are the responsibility for this Contractor at no additional cost to the Contract.

\_\_\_\_\_  
Contractor

\_\_\_\_\_  
Signed by

\_\_\_\_\_  
Address

\_\_\_\_\_  
City, State and Zip

END OF SUBSTITUTION FORM 01 2500a

## SECTION 01 2600 - CONTRACT MODIFICATION PROCEDURES

### PART 1 - GENERAL

#### 1.1 CONTRACT MODIFICATION PROCEDURES

- A. Design Team will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.
- B. Owner-Initiated Proposal Requests: Design Team will issue a detailed description of proposed changes in the Work.
  - 1. Proposal Requests are not instructions either to stop work in progress or to execute the proposed change.
  - 2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time.
- C. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Design Team.
- D. On Owner's approval of a Proposal Request, Design Team will issue a Change Order for signatures of Owner and Contractor, for all changes to the Contract Sum or the Contract Time.
- E. Design Team may issue a Construction Change Directive. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- F. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2600

## SECTION 01 3000 - ADMINISTRATIVE REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 PROJECT MANAGEMENT AND COORDINATION

- A. Subcontract List: Submit a written summary identifying individuals or firms proposed for each portion of the Work.
- B. Key Personnel Names: Within ten (10) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. List e-mail addresses and telephone numbers.
- C. Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work.
- D. Requests for Information (RFIs): On discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI. Use forms acceptable to Design Team and Owner.
- E. Schedule and conduct (2) progress meetings at Project site, coordinated with the Design Team and Owner. **Notify Owner of meeting dates and times.** Require attendance of each subcontractor or other entity concerned with current progress or involved in planning, coordination, or performance of future activities.

#### 1.2 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 1. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  - 2. Submit two copies of each action submittal. Design Team will return one copy.
  - 3. Submit one copy of each informational submittal. Design Team will not return copies.
  - 4. Design Team will discard submittals received from sources other than Contractor.

- B. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
  - 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  - 2. Name file with unique identifier, including project identifier, Specification Section number, and revision identifier.
  - 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Design Team.
- C. Identify options requiring selection by Design Team.
- D. Identify deviations from the Contract Documents on submittals.
- E. Contractor's Construction Schedule Submittal Procedure:
  - 1. Submit required submittals in the following format:
    - a. PDF electronic file.
  - 2. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.

## PART 2 - PRODUCTS

### 2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections.
  - 1. Submit electronic submittals via email as PDF electronic files to Shannon Hicks at GHR Engineers and Associates, Inc.: [shicks@ghrinc.com](mailto:shicks@ghrinc.com).
    - a. Design Team will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

### 2.2 ACTION SUBMITTALS

- A. Submit two paper copies of each submittal unless otherwise indicated. Design Team will return one copy.

- B. Product Data: Mark each copy to show applicable products and options. Include the following:
  - 1. Manufacturer's written recommendations, product specifications, and installation instructions.
  - 2. Wiring diagrams showing factory-installed wiring.
  - 3. Printed performance curves and operational range diagrams.
  - 4. Testing by recognized testing agency.
  - 5. Compliance with specified standards and requirements.
  
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data. Submit on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches. Include the following:
  - 1. Dimensions and identification of products.
  - 2. Fabrication and installation drawings and roughing-in and setting diagrams.
  - 3. Wiring diagrams showing field-installed wiring.
  - 4. Notation of coordination requirements.
  - 5. Notation of dimensions established by field measurement.

## 2.3 INFORMATIONAL SUBMITTALS

- A. Informational Submittals: Submit one paper copy of each submittal unless otherwise indicated. Design Team will not return copies.
  
- B. Qualification Data: Include lists of completed projects with project names and addresses, names and addresses of Design Team and owners, and other information specified.
  
- C. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

## PART 3 - EXECUTION

### 3.1 SUBMITTAL REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Design Team.

- B. Design Team will review each action submittal, make marks to indicate corrections or modifications required, will stamp each submittal with an action stamp, and will mark stamp appropriately to indicate action.
- C. Informational Submittals: Design Team will review each submittal and will not return it, or will return it if it does not comply with requirements. Design Team will forward each submittal to appropriate party.
- D. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01 3000

## SECTION 01 4000 - QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SECTION REQUIREMENTS

- A. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
- B. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements, comply with the most stringent requirement. Refer uncertainties to Design Team for a decision.
- C. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum. The actual installation may exceed the minimum within reasonable limits. Indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Design Team for a decision.
- D. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
  - 1. Date of issue.
  - 2. Project title and number.
  - 3. Name, address, and telephone number of testing agency.
  - 4. Dates and locations of samples and tests or inspections.
  - 5. Names of individuals making tests and inspections.
  - 6. Description of the Work and test and inspection method.
  - 7. Identification of product and Specification Section.
  - 8. Complete test or inspection data.
  - 9. Test and inspection results and an interpretation of test results.
  - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  - 12. Name and signature of laboratory inspector.
  - 13. Recommendations on retesting and reinspecting.



- E. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, notices, receipts for fee payments, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.
- F. Testing Agency Qualifications: An independent agency with the experience and capability to conduct testing and inspecting indicated; and where required by authorities having jurisdiction, that is acceptable to authorities.
- G. Retesting / Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced work that failed to comply with the Contract Documents.
- H. Testing Agency Responsibilities: Cooperate with Design Team and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
  - 1. Notify Design Team and Contractor of irregularities or deficiencies in the work observed during performance of its services.
  - 2. Do not release, revoke, alter or increase requirements of the Contract Documents or approve or accept any portion of the work.
  - 3. Do not perform any duties of Contractor.
- I. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
  - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- J. Tests and Inspections: Owner will engage a qualified inspector to conduct inspections required by authorities having jurisdiction.

PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 REPAIR AND PROTECTION

- A. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.
- B. Contractor will maintain a safe work site at all times. When the project is complete, Contractor shall return the work site and the surrounding areas to the same condition as they were prior to the beginning of the project.

END OF SECTION 01 4000

## SECTION 01 6000 - PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SECTION REQUIREMENTS

- A. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
- B. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced.
  - 1. Show compliance with requirements for comparable product requests.
  - 2. Design Team will review the proposed product and notify Contractor of its acceptance or rejection.
- C. Basis-of-Design Product Specification Submittal: Show compliance with requirements.
- D. Compatibility of Options: If Contractor is given option of selecting between two or more products, select product compatible with products previously selected.
- E. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
  - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Deliver products to Project site in manufacturer's original sealed container or packaging, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 3. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
  - 4. Store materials in a manner that will not endanger Project structure.
  - 5. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
- F. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

- A. Provide products that comply with the Contract Documents, are undamaged, and, unless otherwise indicated, are new at the time of installation.
  - 1. Provide products complete with accessories, trim, finish, and other devices and components needed for a complete installation and the intended use and effect.
  - 2. Where products are accompanied by the term "as selected," Owner will make selection.
  - 3. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. Where the following headings are used to list products or manufacturers, the Contractor's options for product selection are as follows:
  - 1. Products:
    - a. Where requirements include "one of the following," provide one of the products listed that complies with requirements.
    - b. Where requirements do not include "one of the following," provide one of the products listed that complies with requirements or a comparable product.
  - 2. Manufacturers:
    - a. Where requirements include "one of the following," provide a product that complies with requirements by one of the listed manufacturers.
    - b. Where requirements do not include "one of the following," provide a product that complies with requirements by one of the listed manufacturers or another manufacturer.
  - 3. Basis-of-Design Product: Provide the product named, or indicated on the Drawings, or a comparable product by one of the listed manufacturers.

### 2.2 COMPARABLE PRODUCTS

- A. Design Team will consider Contractor's request for comparable product in advance of Bidding only when the following conditions are satisfied:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications.
3. List of similar installations for completed projects, if requested.
4. Samples, where applicable.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 6000

## SECTION 01 7000 - EXECUTION AND CLOSEOUT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 EXECUTION REQUIREMENTS

##### A. Cutting and Patching:

1. Structural Elements: When cutting and patching structural elements, notify Design Team of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
3. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities.

##### B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

#### 1.2 CLOSEOUT SUBMITTALS

- A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- B. Certified List of Incomplete Items: Final submittal at Final Completion.
- C. Operation and Maintenance Data: Submit two (2) copies of manual.
- D. PDF Electronic File: Assemble manual into a composite electronically indexed file. Submit two (2) copies on digital media.
- E. Record Product Data: Submit two (2) paper copies and annotated PDF electronic files and directories of each submittal.

### 1.3 SUBSTANTIAL COMPLETION PROCEDURES

- A. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
- B. Submittals Prior to Substantial Completion: Before requesting Substantial Completion inspection, complete the following:
  - 1. Submit closeout submittals specified in other sections, including project record documents, operation and maintenance manuals, similar final record information, warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 2. Submit maintenance material submittals specified in other sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner.
  - 3. Submit test/adjust/balance records.
- C. Procedures Prior to Substantial Completion: Before requesting Substantial Completion inspection, complete the following:
  - 1. Complete startup and testing of systems and equipment.
  - 2. Perform preventive maintenance on equipment used prior to Substantial Completion.
  - 3. Remove temporary facilities and controls.
  - 4. Complete final cleaning requirements, including touchup painting.
  - 5. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will proceed with inspection or advise Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will advise Contractor of items that must be completed or corrected before certificate will be issued.

### 1.4 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting inspection for determining final completion, complete the following:
  - 1. Submit a final Application for Payment.

2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved.
- B. Submit a written request for final inspection for acceptance. On receipt of request, Design Team will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare final Certificate for Payment after inspection or will advise Contractor of items that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
- B. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

### 2.2 OPERATION AND MAINTENANCE DOCUMENTATION

- A. Directory: Prepare a single, comprehensive directory of operation and maintenance data and materials, listing items and their location to facilitate ready access to desired information.
- B. Organization: Unless otherwise indicated, organize manual into separate sections for each system and subsystem, and separate sections for each piece of equipment not part of a system.



1. Dividers: Provide heavy paper dividers with celluloid-covered tabs for each separate Section. Mark each tab to indicate contents. Provide a typed description of the product and major parts of equipment included in the Section on each divider.
- C. Organize data into three-ring binders with identification on front and spine of each binder, and envelopes for folded drawings. Identify each binder on the front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL", Project title or name, year and subject matter covered. Indicate volume number for multiple volume sets of manuals. Include the following:
1. Manufacturer's operation and maintenance documentation.
  2. Maintenance and service schedules.
  3. Maintenance service contracts. Include name and telephone number of service agent.
  4. Emergency instructions.
  5. Spare parts list and local sources of maintenance materials.
  6. Wiring diagrams.
  7. Copies of warranties. Include procedures to follow and required notifications for warranty claims

### 2.3 RECORD DRAWINGS

- A. Record Prints: Maintain a set of prints of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued. Mark to show actual installation where installation varies from that shown originally. Accurately record information in an acceptable drawing technique.
1. Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings.
1. Format: Annotated PDF electronic file.

## PART 3 - EXECUTION

### 3.1 EXAMINATION AND PREPARATION

- A. Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Verify compatibility with and suitability of substrates.
  - 2. Examine roughing-in for mechanical and electrical systems.
  - 3. Examine walls, floors, and roofs for suitable conditions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Take field measurements as required to fit the Work properly. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication.
- D. Verify space requirements and dimensions of items shown diagrammatically on Drawings.

### 3.2 CONSTRUCTION LAYOUT

- A. Before proceeding to lay out the Work, verify layout information shown on Drawings.

### 3.3 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Conceal wiring in finished areas unless otherwise indicated.
  - 3. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations.
- C. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

- D. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed.
- E. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place. Where size and type of attachments are not indicated, verify size and type required for load conditions.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Owner.
- F. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- G. Use products, cleaners, and installation materials that are not considered hazardous.

#### 3.4 CUTTING AND PATCHING

- A. Provide temporary support of work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- D. Cutting: Cut in-place construction using methods least likely to damage elements retained or adjoining construction.
  - 1. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
- E. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
  - 1. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction in a manner that will minimize evidence of patching and refinishing.

2. Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance.
3. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

### 3.5 CLEANING

- A. Clean Project site and work areas daily, including common areas. Dispose of materials lawfully.
  1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
  3. Remove debris from concealed spaces before enclosing the space.
- B. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion:
  1. Clean Project site and grounds, in areas disturbed by construction activities. Sweep paved areas; remove stains, spills, and foreign deposits. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
  2. Sweep paved areas broom clean. Remove spills, stains, and other foreign deposits.
  3. Remove labels that are not permanent.
  4. Clean transparent materials, including mirrors. Remove excess glazing compounds.
  5. Clean exposed finishes to a dust-free condition, free of stains, films, and foreign substances. Sweep concrete floors broom clean.
  6. Vacuum carpeted surfaces.
  7. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and foreign substances. Clean plumbing fixtures. Clean light fixtures, lamps, globes, and reflectors.

### 3.6 OPERATION AND MAINTENANCE MANUAL PREPARATION

- A. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

- B. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
  - 1. Prepare supplementary text if manufacturers' standard printed data are unavailable and where the information is necessary for proper operation and maintenance of equipment or systems.
- C. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams.

### 3.7 DEMONSTRATION AND TRAINING

- A. Contractor to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system. Include a detailed review of the following:
  - 1. Include instruction for basis of system design and operational requirements, review of documentation, emergency procedures, operations, adjustments, troubleshooting, maintenance, and repairs.
- B. Contractor shall train Owner's teaching faculty on the online monitoring functionality of new system.

END OF SECTION 01 7000

## SECTION 01 7419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

### PART 1 - GENERAL (Not Used)

### PART 2 - PRODUCTS (Not Used)

### PART 3 - EXECUTION

#### 3.1 PLAN IMPLEMENTATION

- A. General: Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
  - 1. Review locations established for recycling and disposal.

#### 3.2 RECYCLING WASTE

- A. Packaging:
  - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - 2. Polystyrene Packaging: Separate and bag materials.
  - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:
  - 1. Sort and stack reusable members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
  - 2. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  - 3. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- C. Metals: Separate metals by type.

### 3.3 DISPOSAL OF WASTE

- A. Except for items or materials to be recycled or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
- B. Recycle recyclable materials off-site.
- C. Do not burn waste materials.

END OF SECTION 01 7419

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. HVAC Contractor: Provide and install heating, ventilating and air conditioning systems as shown on the drawings and as specified herein. Work includes but is not limited to the following:
  - a. Demolition
  - b. Drain piping
  - c. Refrigerant piping and accessories
  - d. Flex connections

B. Work Not Included

1. Materials, equipment or final connections to items of equipment specified or noted on the drawings to be furnished or executed under another contract.

1.2 RELATED WORK

A. Specified elsewhere:

1. Sections: Architectural / Structural and General Work
2. Section 22 00 20 - Mechanical Insulation
3. Division 23 - Mechanical Systems

1.3 QUALITY ASSURANCE

- A. Use only new material and apparatus of the specified design and manufacturer. Furnish all materials in accordance with latest ANSI, AWWA, ASTM, NFPA, AGA, ASME, IBR, UL standards and other applicable standards or codes.

1.4 SUBMITTALS

- A. See Architectural Sections for requirements.

PART 2 - PRODUCTS

2.1 REFRIGERATION PIPING

- A. Refrigeration piping shall be Type ACR hard drawn sealed and nitrogen filled special refrigeration duty copper. Fittings shall be wrought copper streamline fittings and all elbows shall be long radius.



- B. Brazing shall be silver alloy having a minimum melting point of 1185°F. Piping shall be filled with oil pumped dry nitrogen during all brazing operations.
- C. After the system is installed and before any piping is insulated, the entire refrigeration circuit must be thoroughly leak tested. The following test procedure is recommended:
1. Remove and plug the connection points of any controls or relief valves that could be damaged by test pressure. Since the compressor is not included in the leak test, front seat both the compressor suction and discharge valves. Open the liquid line shutoff valve at the condenser, any auxiliary valves in the hot gas and liquid lines and the liquid solenoid valve(s). If the solenoid valve(s) is not equipped with a manual opening device, apply control power to the solenoid(s), opening the valve(s).
  2. Connect a cylinder of oil-pumped, dry nitrogen to the frontseat port of the compressor discharge valve, if the valve is so equipped. If not, make the connection at the liquid line charging valve. Note: It is important that the pressure of the nitrogen be controlled by a reducing valve. Control is absolutely necessary because the pressure within a full cylinder of nitrogen is in excess of 2,000 psi at room temperature.
  3. Set the pressure regulator on the nitrogen cylinder at 150 psig or the leak test pressure specified by local code. Open the shutoff valve on the cylinder and the valve of the manifold and charge enough nitrogen into the system to raise the pressure to 150 psig, or to the pressure required by local code. Close the manifold valve.
  4. Using a rubber or rawhide mallet, tap each solder connection sufficiently hard to start any leak that might subsequently open from thermal expansion and contraction or vibration.
  5. Test all pipe joints for leaks. First, check the manifold gauge. If the pressure is dropping, a major leak is present. Large leaks are detected by the sound of escaping gas. Smaller leaks are located by brushing each connection with a soap solution and watching for tell-tale bubbles. Adding a small amount of glycerine to the soap solution improves the bubbling action. Make certain that all joints are inspected thoroughly. Mark carefully any spots where leaks occur.
  6. After the bubble test is completed, close the cylinder shutoff valve and bleed the test pressure through the unused part of the manifold. Repair any leaks found. Leaks are repaired by disassembling the connection, cleaning the fitting and remaking. No attempt should be made to repair a leak by simply adding brazing material.
  7. After the system is assumed to be free of leaks, charge enough refrigerant through the liquid line charging valve to raise the system pressure to approximately 10 psig. Remove the refrigerant connection and charge enough nitrogen into the system to raise the test pressure to 150 psig or to the local code requirement.
  8. Check all parts of the system with a halide torch or electronic leak detector. The presence of escaping refrigerant will color the flame of the halide torch green if the leak is small or a dense blue if it is large. An electronic leak detector indicates the presence of a leak by either a gauge reading, signal light or an audible sound. If any leaks are found, relieve the test pressure and repair the faulty area. Recharge the system, as described previously, and allow it to remain under pressure for 24 hours. If, at the end of this period, there is no appreciable

pressure change, the system may be considered free of leaks. Note: The system pressure will change approximately 3 psig with each 10°F rise or fall in ambient temperature.

9. With the testing complete, relieve the test pressure and reconnect any valves or controls that were disconnected previously.

D. Evacuation

1. To speed the evacuation, connect the vacuum pump to as many points of the system as possible. To register the vacuum developed by the pump, a reliable vacuum gauge, such as a Zimmerli Gauge or an electronic vacuum gauge, is connected to the liquid line charging valve. The compressor valves are then cracked off of their backseats, moving the valve disc to an intermediate position between the backseat and the frontseat of the valve. Open the liquid line charging valve.
2. The vacuum pump shall be started and operated until a vacuum equivalent to 500 microns is registered by the vacuum gauge. The length of time required to achieve the 500 micron reading depends upon the size of the system and the amount of moisture within the system. Failure to reach the required vacuum reading may be due to:
  - a. Presence of a large amount of moisture. This will be removed with continued operation of the vacuum pump.
  - b. Inefficiency of the pump. Leaks within the pump or contaminated pump oil may be the cause. This may be checked by operating the pump against a vacuum gauge.
  - c. A system leak.
3. When the system has been evacuated, close the suction valve on the vacuum pump and then stop the pump. Backseat one of the compressor valves and remove the vacuum pump connection. Through this valve port charge enough oil-pumped dry nitrogen into the system to raise the pressure to atmospheric. Re-evacuate the system. Any moisture remaining in the system is absorbed by the dry nitrogen gas and is removed by the second evacuation.
4. After the 500 micron vacuum reading has been re-established, close the vacuum pump suction valve and stop the pump. Backseat the compressor valves and allow the system to stand under vacuum for a minimum of 12 hours. If the vacuum reading remains unchanged, the system is ready to receive its charge of refrigerant.

E. Charge system with proper quantity of refrigerant and lubricant.

F. Insulate suction line with foamed plastic insulation. See Specification Section 22 00 20.

G. Forward shop drawing submittals to Architect / Engineer for review. Submittal shall include complete sketch of refrigerant piping system, sizes, fittings and lengths. Indicate on sketch that manufacturer approves layout and that warranty applies. (HVAC Contractor shall note that pipe sizes and layouts on drawings are for the

purpose of establishing a bid price. Final sizing and layout shall be determined and approved by refrigeration equipment manufacturer.)

- H. Refrigerant purge and relief shall be piped full size in separate lines to outdoors using materials specified for refrigerant piping.

## 2.2 REFRIGERATION ACCESSORIES

- A. Furnish and install the following specialties in refrigeration piping from each unit:

1. 1 - liquid line catch-all filter-drier sized for 2 psi maximum pressure drop (with 3-valve bypass).
2. 1 - solenoid valve with 120 volt, 60 cycle coil on each refrigerant circuit.
3. 1 - expansion valve with external equalizer on each refrigerant circuit.
4. 1 - liquid indicator with moisture indicating bull's-eyes in each circuit immediately upstream of expansion valve.
5. Charging valves.
6. Hot gas discharge muffler in each compressor circuit. Muffler shall be suitable for horizontal or vertical installation, self-draining.

- B. Acceptable Manufacturers

1. Mueller Brass Company
2. Henry Valve Company
3. Sporlan

## 2.3 REFRIGERANTS - GENERAL

- A. Recover and Recycle Refrigerants

1. Refrigerant used in centrifugal water chillers should be recovered and / or recycled for reuse, reprocessed (reclaimed), or properly disposed of, whenever it is removed from the equipment. Never release to atmosphere!
2. Always determine recycle or reclaim requirements of the refrigerant before beginning recovery procedure. Obtain a chemical analysis of the refrigerant if necessary. (Questions about recovered refrigerant and acceptable refrigerant quality standards are addressed in ARI Standard 700.)

- B. Refrigerant Handling and Safety

1. Consult manufacturer's Material Safety Data Sheets (MSDS) on refrigerants being handled to understand health, safety, storage, handling and disposal requirements. Use approved containment vessels and refer to appropriate safety standards. Comply with all applicable transportation standards when shipping refrigerant containers.

- C. Service Equipment and Procedures

1. To minimize refrigerant emissions while recovering the refrigerant, use recycling equipment such as a Trane "recycle / recovery system" or equivalent. Use

equipment and methods which will pull the lowest possible system vacuum while recovering and condensing refrigerant. Equipment capable of pulling a vacuum of less than (500 microns - 1.0 mm) of mercury is recommended. Do not open the unit to atmosphere for service work until the refrigerant charge is fully removed/recovered.

2. Evacuation prior to charging should be done with a vacuum pump capable of pulling a vacuum of (500 microns - 1.0 mm) of mercury or less. The unit should stand for 12 hours and the vacuum should not rise above 2,500 microns (2.5 mm) of mercury. A rise above 2,500 microns (2.5 mm) of mercury indicates a leak test is required to locate and repair any leaks. A leak test will be required on any repaired area. Charge refrigerant into the machine only when it is determined that the machine does not leak or contain moisture. Charge refrigerant into the machine by weight. A proper charge is required for efficient machine operation. When charging is complete, purge or drain charging lines into an approved refrigerant container. Seal all used refrigerant containers with approved closure devices to prevent unused refrigerant from escaping to the atmosphere. Take extra care to properly maintain all service equipment directly supporting refrigerant service work such as gauges, hoses, vacuum pumps, and recycling equipment.
3. When cleaning system components or parts, avoid using CFC-11 (R-11) or CFC-113 (R-113). Use only cleaning solvents that do not have ozone depletion factors. Properly dispose of used materials. Refrigeration system cleanup methods using filters and driers are preferred.

### PART 3 - EXECUTION

#### 3.1 DEMOLITION

- A. Pertinent Contractor shall remove all existing materials, system components, accessories and related items that will not be re-used.
- B. HVAC Contractor shall ensure that system is inactive before disabling the system. HVAC Contractor shall ensure that removal of system will not compromise the Owner's operations before removal occurs.
- C. Partial removals shall extend back to nearest active main. Provide and install caps or pipe plugs at main for all piping including pneumatic lines.
- D. No piping shall be left open as a result of demolition operations. Cap or plug all open piping (including pneumatic lines). Crimping is not an acceptable means of capping piping.
- E. Refrigerant associated with demolished systems/equipment shall be reclaimed by HVAC Contractor in accord with applicable regulations. Such refrigerant becomes the property of the HVAC Contractor unless stated otherwise.
- F. All hangers and clamps shall be removed as part of demolition work if they are not re-used.

- G. All removed equipment and materials become the property of the pertinent removing Contractor unless otherwise noted.

### 3.2 DRAIN LINES

- A. HVAC Contractor shall provide and install a complete drain system from all coil drain pans in all air handling units, fan coils, evaporator coils and cooling coils. On double sloped pans and / or pans with two drain connections provide drains on both sides.
  - 1. Where multiple, stacked cooling coils are used each coil shall have its own drain pan. Provide internal drop tubes from each such pan down to the main drain pan.
- B. All drains shall be trapped. Traps shall be designed to withstand the maximum (positive or negative) pressures imposed on them by service without ponding or retaining water in the pans.
  - 1. Dimension from bottom of pan outlet to trap invert shall be equal to two times unit static pressure (in inches of water) plus unit velocity head (in inches of water).
  - 2. Dimension from bottom of trap to trap outlet shall be equal to two times unit static pressure (in inches of water).
- C. Drain lines shall be the same size as the pan outlet connections.
- D. All drain lines shall slope uniformly to termination point at slope of 1/8" per foot.
- E. Terminate drain lines at floor drains with indirect connection.

END 23 0510

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. Test and Balance Contractor: Test, adjust and balance air and piping systems. Work includes but is not limited to the following.
2. Test and Balance
  - a. Air systems
  - b. Control system tests
  - c. Reports

1.2 RELATED WORK

A. Specified elsewhere:

1. Sections: Architectural / Structural and General Work:
2. Division 23 - Mechanical
3. Division 26 - Electrical

1.3 JOB CONDITIONS

- A. Heating, ventilating, and air conditioning equipment shall be completely installed and in continuous operation to accomplish the testing, adjusting and balancing work specified. Complete air balancing prior to hydronic balancing.
- B. Perform testing, adjusting and balancing when outside conditions approximate design conditions for heating and cooling functions or when the system is operating at design capacity.
- C. The Architect / Engineer may be present during testing and balancing to verify that specified procedures are followed.

1.4 QUALITY ASSURANCE

- A. Testing and balancing shall be performed by independent firms specializing in such work.
  1. The Test and Balance Contractor shall not be related to the Plumbing or HVAC Contractor in any business enterprise.
- B. Only qualified personnel shall perform testing and balancing work.

- C. Submit evidence that the personnel who will perform the testing and balancing of the project systems are qualified personnel for review by the Architect / Engineer prior to performing the work.
- D. Submit a list of completed projects successfully tested and balanced by the submitted qualified personnel for review by the Architect / Engineer, prior to performing the work.
- E. Perform all corrective measures caused by faulty installation. Retest, readjust and rebalance systems until satisfactory results are achieved.

## 1.5 DEFINITION

- A. Qualified personnel are:
  - 1. Personnel who have been certified by one of the following test and balance organizations.
    - a. AABC - Associated Air Balance Council.
    - b. Certified TBAB - Certified Testing, Balancing and Adjusting Bureau.
    - c. NEBB - National Environmental Balancing Bureau, Illinois Chapter.
    - d. SMARTA - Sheet Metal, Air Conditioning & Roofing Contractors Trade Association of Illinois.
    - e. TABIC - Test & Balancing Institute for Certification.

## 1.6 SUBMITTALS

- A. Submit data sheets on each item of testing equipment for Architect / Engineer review. Include name of device, manufacturer's name, model number, latest date of calibration and correction factors.
- B. Submit a report containing all test data and other related information recorded during testing and balancing, placed on appropriate forms for Architect / Engineer review. Reports shall certify that the methods used and results achieved are as specified.

## 1.7 REVERIFICATION

- A. During Substantial Completion Inspection, a percentage (not more than 5%) of the recorded data will be subject to reverification by the Architect / Engineer. Take instrument readings as directed. Test points will be in normally accessible locations and randomly selected by Architect / Engineer.

## PART 2 - PRODUCTS

### 2.1 AIR BALANCE INSTRUMENTS

- A. Velometer with probes and Pitot tube.
- B. Rotating vane anemometer.

- C. ASHRAE standard Pitot tubes stainless steel 5/16 outside diameter, lengths 18" and 36".
- D. Magnehelic differential air pressure gauges, 0 to 0.5", 0 to 1.0" and 0 to 5.0" water pressure ranges, each arranged as a portable unit for use with a standard Pitot tube.
- E. Combination inclined-vertical portable manometer, range 0 to 5.0" water.
- F. Portable-type hook gauge, range 0 to 12" water.
- G. Portable flexible U-tube manometer, magnetic mounting clips, range 0 to 18" water.
- H. Conical or pyramidal shaped hood.

## 2.2 SYSTEM PERFORMANCE MEASURING INSTRUMENTS

- A. Insertion thermometers, with graduations at 0.1°F or contact pyrometer.
- B. Sling psychrometer.
- C. Tachometer, centrifugal type.
- D. Revolution counter.
- E. Clamp-on volt-ammeter.
- F. Recorders, portable type for temperature and humidity.

## PART 3 - EXECUTION

### 3.1 DRIVES

- A. All VAV systems shall be provided with new, appropriately sized drives such that the full range of the pertinent VFD's is available for control of duct static pressure. VAV systems shall not be balanced using the VFD's.

### 3.2 AIR SYSTEMS

- A. Test, adjust and balance systems in accord with the following:
  1. Preliminary:
    - a. Identify and list size, type and manufacturer of all equipment to be tested, including air terminals. Inspect all system components for proper installation and operation.
    - b. Use manufacturers' ratings for all equipment to make calculations except where field test shows ratings to be impractical.
    - c. Verify that all instruments are accurately calibrated and maintained.
    - d. Install clean filters.



2. Central System:
  - a. Test, adjust and record supply, return fan RPM to design requirements within the limits of mechanical equipment provided.
  - b. Test and record motor voltage and running amperes including motor nameplate data and starter heater ratings.
  - c. Make pitot tube traverse of main supply, exhaust and return ducts, determine and record cfm at fans and adjust fans to design cfm.
  - d. Test and record system static pressure, suction and discharge.
  - e. Test and adjust system for design minimum outside air, cfm.
  - f. Test and adjust systems for design return air, cfm.
  - g. Test and record heating apparatus entering air temperatures, dry bulb.
  - h. Test and record cooling apparatus entering air temperatures, dry bulb and wet bulb.
  - i. Test and record heating apparatus leaving air temperatures, dry bulb.
  - j. Test and record cooling apparatus leaving air temperatures, dry bulb and wet bulb.
3. Distribution: Adjust zones or branch ducts to proper design cfm, supply and return.
4. Air Terminals:
  - a. Identify each air terminal from reports as to location and determine required flow reading.
  - b. Test and adjust each air terminal to within 10% of design requirement.
  - c. Test procedure on air terminals shall include comparison of specified fpm velocity and observed velocity, adjustment of terminal and comparison of specified cfm and observed cfm after adjustment.
  - d. Adjust flow patterns from air terminal units to minimize drafts to extent design and equipment permits.
5. Verification:
  - a. Prepare summation of readings of observed cfm for each system, compare with specified cfm and verify that duct losses are within specified allowable range. Determine coil and filter static pressure drops.
  - b. Verify design cfm at fans as described above.

### 3.3 TESTING, BALANCING AND ADJUSTING

- A. At the completion of the installation of the air distribution systems, the following tests shall be made.
- B. All instruments for testing are to be furnished by this Contractor and must be reviewed by the Architect / Engineer before use on job. All readings shall be recorded on approved forms. All instruments used shall be recently calibrated and same set of instruments shall be used throughout the balancing procedures.

- C. The air distribution systems shall be balanced with the volume dampers, splitter dampers and adjustable air extractors in the duct systems as follows:
1. All air handling equipment in building shall be operating during the balancing procedures. Supply systems with return fans shall be balanced in the 100% outside air position. System shall then be set in minimum outside air position and manual volume damper after automatic return air dampers adjusted to maintain constant supply air volume. Supply systems without return fans shall be adjusted to the minimum outside air position. All filters shall be new and clean. All volume dampers and extractors shall be set at 2/3 open position.
  2. Fans shall be adjusted to specified air quantities by using rotating vane anemometer traverse over entering air face of cooling coils in built-up air handling systems, with pitot tube and inclined manometer or a velometer having proper duct jet attachment for traverse at fan inlet.
  3. Individual outlets shall be adjusted to specified air quantities using either the "proportional method" starting at last outlet and working towards main or the "trial and error" method, with a velometer having proper attachment or a rotating vane anemometer.
  4. Branch ducts (having more than one outlet) shall be adjusted to specified air quantities by using a pitot tube and inclined anemometer or a velometer having proper duct jet attachment for traverse as near to takeoff as practical.
  5. Above procedures shall essentially be followed for all systems and shall be repeated until proper balance is achieved throughout systems from -0% to +10% of specified air quantities.
- D. After balance is completed, lock nuts or stop screws shall be installed at all volume dampers and extractors to permit them to be shut-off but prevent opening beyond the set balance position.
- E. For more detailed step-by-step procedures the Balancing and Adjustment Manual for Air Distribution Systems published by Sheet Metal and Air Conditioning Contractors National Association shall be used.
- F. All readings taken throughout the balancing procedure shall be recorded on approved forms and upon completion of balancing and testing shall be "certified" as being correct and submitted for review.
- G. Upon receipt of "certified" balancing forms and letter of certification that all balancing, testing and adjusting is completed in accordance with plans and specifications and that all systems are operating properly, the Architect / Engineer or his designated representative will conduct a balance inspection. Furnish personnel, instruments and equipment as required to assist the Architect / Engineer during this "balance inspection".
- H. If during the above balance inspection any portion of any system is found in improper balance, that entire system shall be rebalanced and a new report submitted. The rebalance shall be checked and if again found in improper balance, this Contractor shall again rebalance and submit report. This procedure shall be repeated until the systems are properly balanced to the satisfaction of the Architect / Engineer.

### 3.4 AUTOMATIC CONTROL SYSTEM

- A. The Temperature Control Contractor shall set and adjust automatically operated devices to achieve specified sequence of operation.
- B. Testing organization shall verify all controls for proper calibration and list those controls requiring adjustment by temperature control system installer.

### 3.5 SYSTEM PERFORMANCE REPORT

- A. After the conclusion of balancing operations, make temporary installation of portable recorders and simultaneously record temperatures and humidity during summer and winter conditions at representative locations in each system.
- B. Architect / Engineer will direct all test locations.
- C. Make recordings during summer and winter for a seven-day period, continuous over a weekend, and including at least one period of operation at outside conditions within 5°F wet bulb temperature of maximum summer design condition and within 10°F dry bulb temperature of minimum winter design condition.
- D. Report of test results shall include original recording and two reproductions.

### 3.6 SUBMISSION OF REPORTS

- A. Fill in test results on approved forms.
- B. Submit three certified copies of required test reports to the Architect / Engineer for review.
- C. Include in report a list of instruments used and test date of calibration.
- D. Submittals shall be legibly signed by the individual(s) responsible for the accuracy of the

END 23 0593

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. Provide and install complete insulation systems as shown on the drawings and as specified herein. Work includes, but is not limited to, the following:

- a. HVAC Contractor: Insulating of:

- (1) Refrigerant piping
    - (2) Ductwork

1.2 RELATED WORK

A. Specified elsewhere:

1. Division 23 - Mechanical Systems

1.3 QUALITY ASSURANCE

- A. Installations shall be by qualified personnel thoroughly trained and experienced in the skills required and completely familiar with the manufacturer's current recommended methods of installation as well as the requirements of the work.
- B. All insulation shall be applied in accordance with MICA "Commercial and Industrial Insulation Standards".

1.4 SUBMITTALS

- A. See Architectural Sections.
- B. Provide submittals for:
  1. Equipment insulation
  2. Plastic insulation jacket
  3. Duct insulation

PART 2 - PRODUCTS

2.1 INSULATION

- A. Materials of insulation shall be manufactured by Johns-Manville, Schuller, Owens Corning, Knauf, Rubatex, Armstrong, Certain-Teed (acceptable manufacturers will vary depending upon material being specified herein after).

- B. Insulation shall be rigid glass fiber with fire retardant vapor barrier jacket. Insulation of fittings shall be in accordance with manufacturer's recommendations using glass fiber wrapping and formed jacket.
- C. Insulating materials and APT jackets shall conform to latest NFPA and IECC standards with flame-spread rating not to exceed 25 and smoke developed rating not to exceed 50. Vapor barrier jackets shall have a water vapor permeability rating not to exceed .02 perms when tested in accordance with ASTM Standard E-96.

## 2.2 MINERAL-FIBER INSULATION INSTALLATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
  - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
    - e. Impale insulation over pins and attach speed washers.
    - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  - 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be

insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
  - a. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
  - b. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
  
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
  1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
    - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic

applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### PART 3 - EXECUTION

#### 3.1 DUCT INSULATION

- A. Supply, outdoor, relief air (between dampers and outdoors) and exhaust air (between dampers and outdoors) duct insulation shall be the following:
  1. Mineral Fiber Blanket: 1-1/2 inches thick, 1.0 lb / cu. ft. nominal density.
- B. Access doors and fire dampers shall be insulated with the following:
  1. Mineral Fiber Blanket: 1-1/2 inches thick, 1.0 lb / cu. ft. nominal density.
- C. Exposed ductwork in finished areas shall be insulated with the following:
  1. Mineral Fiber Board Insulation: 1-1/2 inches thick,  $\geq 3$  lb / cu. ft. nominal density.
  2. Board insulation to be painted shall have all service jacket.
  3. Board insulation not to be painted shall have foil jacket.
  4. Supply ductwork from heating only make-up air units does not require duct insulation. The discharge air temperature shall not exceed in a difference of 15 degrees F compared to the surrounding space temperature.
  5. Exposed round ductwork to be double wall insulated spiral.
- D. Finish areas include storage rooms, server rooms and bus
- E. Concealed type 1 kitchen hood exhaust duct and plenum insulation shall be fire-rated blanket or board; thickness as required to achieve 2 hour fire rating.
- F. Generator exhaust and muffler insulation shall be fire-rated blanket or board; thickness as required to achieve 2 hour fire rating.

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.
- B. Related Sections include the following:
  - 1. Division 23 Section "Meters and Gages for HVAC Piping" for measuring equipment that relates to this Section.
  - 2. Division 23 Section "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.

1.3 DEFINITIONS

- A. DDC: Direct digital control.
- B. I/O: Input/output.
- C. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.
- D. MS/TP: Master slave/token passing.
- E. PC: Personal computer.
- F. PID: Proportional plus integral plus derivative.
- G. RTD: Resistance temperature detector.
- H. IP: Internet protocol.



## 1.4 SYSTEM PERFORMANCE

### A. Comply with the following performance requirements:

1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
  - a. Water Temperature: Plus or minus 1 deg F.
  - b. Water Flow: Plus or minus 5 percent of full scale.
  - c. Water Pressure: Plus or minus 2 percent of full scale.
  - d. Space Temperature: Plus or minus 1 deg F.
  - e. Ducted Air Temperature: Plus or minus 1 deg F.
  - f. Outside Air Temperature: Plus or minus 2 deg F.
  - g. Dew Point Temperature: Plus or minus 3 deg F.
  - h. Temperature Differential: Plus or minus 0.25 deg F.
  - i. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
  - j. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
  - k. Air Pressure (Space): Plus or minus 0.01-inch wg.
  - l. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
  - m. Carbon Dioxide: Plus or minus 50 ppm.
  - n. Electrical: Plus or minus 5 percent of reading.

## 1.5 SUBMITTALS

- ### A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.

2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
  3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
  2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
  3. Wiring Diagrams: Power, signal, and control wiring.
  4. Details of control panel faces, including controls, instruments, and labeling.
  5. Written description of sequence of operation.
  6. Schedule of dampers including size, leakage, and flow characteristics.
  7. Schedule of valves including flow characteristics.
  8. DDC System Hardware:
    - a. Wiring diagrams for control units with termination numbers.
    - b. Schematic diagrams and floor plans for field sensors and control hardware.
    - c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
  9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
  10. Controlled Systems:
    - a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
    - b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
    - c. Written description of sequence of operation including schematic diagram.
    - d. Points list.
- C. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.
- D. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with LonWorks.
- E. Samples for Initial Selection: For each color required, of each type of thermostat or sensor cover with factory-applied color finishes.
- F. Samples for Verification: For each color required, of each type of thermostat or sensor cover.
- G. Software and Firmware Operational Documentation: Include the following:

1. Software operating and upgrade manuals.
  2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
  3. Device address list.
  4. Printout of software application and graphic screens.
  5. Software license required by and installed for DDC workstations and control systems.
- H. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.
- I. Qualification Data: For Installer and manufacturer.
- J. Field quality-control test reports.
- K. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
  2. Interconnection wiring diagrams with identified and numbered system components and devices.
  3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
  4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
  5. Calibration records and list of set points.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with ASHRAE 135 for DDC system components.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where the equipment manufacturer's factory packaged controls are capable of providing the BAS interface specified, the equipment manufacturer's controls may be utilized. Where controls are provided by other than the equipment manufacturer, arrange for shipping of required devices to equipment manufacturer for factory mounting as required for proper equipment function.
- B. System Software: Update to latest version of software at Project completion.

## 1.8 COORDINATION

- A. Coordinate location of thermostats and other exposed control sensors with plans and room details before installation.
- B. Coordinate equipment with Division 27 Section "Clock Systems" to achieve compatibility with equipment that interfaces with that system.
- C. Coordinate equipment with Division 26 Section "Network Lighting Controls" to achieve compatibility with equipment that interfaces with that system.
- D. Coordinate equipment with Division 28 Section "Fire Detection and Alarm" to achieve compatibility with equipment that interfaces with that system.
- E. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.
- F. Coordinate equipment with Division 26 Section "Electrical Power Monitoring and Control" to achieve compatibility of communication interfaces.
- G. Coordinate equipment with Division 26 Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.
- H. Coordinate equipment with Division 26 Section "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

## 1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Replacement Materials: One replacement for each unique valve motor, controller, thermostat, positioning relay.
  - 2. Maintenance Materials: Five thermostat adjusting key(s).

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 CONTROL SYSTEM

- A. Manufacturers (Note: See drawings for Contractor scope.):
  1. Alpha Controls.
  2. Entec.
  3. Standalone.
- B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.
- C. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation shall permit interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.
- D. Expand existing temperature control system software database to include all new controlled mechanical equipment. Control system shall be accessible via campus Ethernet network.

## 2.3 DDC EQUIPMENT

- A. Operator Workstation and Printer: Existing operator workstation and printer are to be retained.
  1. Application Software: Modify existing temperature control software as necessary to provide the level of control specified herein for new and existing equipment and systems.
    - a. I/O capability from operator station.
    - b. System security for each operator via software password and access levels.
    - c. Automatic system diagnostics; monitor system and report failures.
    - d. Database creation and support.
    - e. Automatic and manual database save and restore.
    - f. Dynamic color graphic displays with up to 10 screen displays at once.
    - g. Custom graphics generation and graphics library of HVAC equipment and symbols.
    - h. Alarm processing, messages, and reactions.
    - i. Trend logs retrievable in spreadsheets and database programs.
    - j. Alarm and event processing.
    - k. Object and property status and control.
    - l. Automatic restart of field equipment on restoration of power.
    - m. Data collection, reports, and logs. Include standard reports for the following:

- 1) Current values of all objects.
- 2) Current alarm summary.
- 3) Disabled objects.
- 4) Alarm lockout objects.
- 5) Logs.

- n. Custom report development.
- o. Utility and weather reports.
- p. Workstation application editors for controllers and schedules.
- q. Maintenance management.

2. Custom Application Software:

- a. English language oriented.
- b. Full-screen character editor/programming environment.
- c. Allow development of independently executing program modules with debugging/simulation capability.
- d. Support conditional statements.
- e. Support floating-point arithmetic with mathematic functions.
- f. Contains predefined time variables.

B. Diagnostic Terminal Unit: Portable notebook-style, PC-based microcomputer terminal capable of accessing system data by connecting to system network with minimum configuration as follows:

1. System: With one integrated USB 2.0 port, integrated Intel Pro 10/100 (Ethernet), integrated audio, bios, and hardware monitoring.
2. Processor: Core 2, 2.0 GHz.
3. Random-Access Memory: 1.0 GB.
4. Graphics: Video adapter, minimum 1024 x 768 pixels, 64-MB video memory.
5. Monitor: 15 inches, LCD color.
6. Keyboard: QWERTY 105 keys in ergonomic shape.
7. Hard-Disk Drive: 80 Gb.
8. CD-ROM Read/Write Drive: 48x24x48.
9. Pointing Device: Touch pad or other internal device.

C. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.

1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
  - a. Global communications.

- b. Discrete/digital, analog, and pulse I/O.
  - c. Monitoring, controlling, or addressing data points.
  - d. Software applications, scheduling, and alarm processing.
  - e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
3. Standard Application Programs:
- a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, antishort cycling, PID control, DDC with fine tuning, and trend logging.
  - b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
  - c. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
  - d. Remote communications.
  - e. Maintenance management.
  - f. Units of Measure: Inch-pound and SI (metric).
4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
5. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
6. LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.
- D. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
- 1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
  - 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
    - a. Global communications.
    - b. Discrete/digital, analog, and pulse I/O.
    - c. Monitoring, controlling, or addressing data points.
  - 3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
  - 4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
  - 5. LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.

- E. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
  - 1. Binary Inputs: Allow monitoring of on-off signals without external power.
  - 2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
  - 3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
  - 4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
  - 5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
  - 6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
  - 7. Universal I/Os: Provide software selectable binary or analog outputs.
  
- F. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
  - 1. Output ripple of 5.0 mV maximum peak to peak.
  - 2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
  - 3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.
  
- G. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
  - 1. Minimum dielectric strength of 1000 V.
  - 2. Maximum response time of 10 nanoseconds.
  - 3. Minimum transverse-mode noise attenuation of 65 dB.
  - 4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

## 2.4 UNITARY CONTROLLERS

- A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
  - 1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
  - 2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform



scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.

3. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.
4. LonWorks Compliance: Communicate using EIA/CEA 709.1 datalink/physical layer protocol using LonTalk protocol.
5. Enclosure: Dustproof rated for operation at 32 to 120 deg F.
6. Enclosure: Waterproof rated for operation at 40 to 150 deg F.

## 2.5 ANALOG CONTROLLERS

- A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.
- B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F, and single- or double-pole contacts.
- C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
  1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.
- D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.

## 2.6 ELECTRONIC SENSORS

- A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
- B. Thermistor Temperature Sensors and Transmitters:
  1. Manufacturers:
    - a. BEC Controls Corporation.
    - b. Ebtron, Inc.
    - c. Heat-Timer Corporation.
    - d. I.T.M. Instruments Inc.
    - e. MAMAC Systems, Inc.
    - f. RDF Corporation.

2. Accuracy: Plus or minus 0.5 deg F at calibration point.
3. Wire: Twisted, shielded-pair cable.
4. Insertion Elements in Ducts: Single point; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
5. Averaging Elements in Ducts: 72 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft..
6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.
7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
  - a. Set-Point Adjustment: Concealed.
  - b. Set-Point Indication: Exposed.
  - c. Thermometer: Red-reading glass.
8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

C. RTDs and Transmitters:

1. Manufacturers:
  - a. BEC Controls Corporation.
  - b. MAMAC Systems, Inc.
  - c. RDF Corporation.
2. Accuracy: Plus or minus 0.2 percent at calibration point.
3. Wire: Twisted, shielded-pair cable.
4. Insertion Elements in Ducts: Single point, 8 inches or 18 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
5. Averaging Elements in Ducts: 48 inches long, rigid; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
6. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
  - a. Set-Point Adjustment: Concealed.
  - b. Set-Point Indication: Exposed.
  - c. Thermometer: Red-reading glass.
8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

D. Humidity Sensors: Bulk polymer sensor element.

1. Manufacturers:
  - a. BEC Controls Corporation.
  - b. General Eastern Instruments.

- c. MAMAC Systems, Inc.
  - d. ROTRONIC Instrument Corp.
  - e. TCS/Basys Controls.
  - f. Vaisala.
2. Accuracy: 5 percent full range with linear output.
  3. Room Sensor Range: 20 to 80 percent relative humidity.
  4. Room Sensor Cover Construction: Manufacturer's standard locking covers.
    - a. Set-Point Adjustment: Exposed.
    - b. Set-Point Indication: Exposed.
  5. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
  6. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of minus 22 to plus 185 deg F.
  7. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.
- E. Pressure Transmitters/Transducers:
1. Manufacturers:
    - a. BEC Controls Corporation.
    - b. General Eastern Instruments.
    - c. MAMAC Systems, Inc.
    - d. ROTRONIC Instrument Corp.
    - e. TCS/Basys Controls.
    - f. Vaisala.
  2. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
    - a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
    - b. Output: 4 to 20 mA.
    - c. Building Static-Pressure Range: 0- to 0.25-inch wg.
    - d. Duct Static-Pressure Range: 0- to 5-inch wg.
  3. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
  4. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.
  5. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
  6. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.

- F. Room Sensor Cover Construction: Manufacturer's standard locking covers.
  - 1. Set-Point Adjustment: Exposed.
  - 2. Set-Point Indication: Exposed.
- G. Room sensor accessories include the following:
  - 1. Insulating Bases: For sensors located on exterior walls.
  - 2. Adjusting Key: As required for calibration and cover screws.
- H. Photocell, see Section 23 0993 for description.

## 2.7 STATUS SENSORS

- A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg.
- B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig, piped across pump.
- C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.
- D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.
- E. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.
- F. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.
- G. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
- H. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.
  - 1. Manufacturers:
    - a. BEC Controls Corporation.
    - b. I.T.M. Instruments Inc.

## 2.8 GAS DETECTION EQUIPMENT

### A. Manufacturers:

1. B. W. Technologies.
2. CEA Instruments, Inc.
3. Ebtron, Inc.
4. Gems Sensors Inc.
5. Greystone Energy Systems Inc.
6. Honeywell International Inc.; Home & Building Control.
7. INTEC Controls, Inc.
8. I.T.M. Instruments Inc.
9. MSA Canada Inc.
10. QEL/Quatrosense Environmental Limited.
11. Sauter Controls Corporation.
12. Sensidyne, Inc.
13. TSI Incorporated.
14. Vaisala.
15. Vulcain Inc.

B. Carbon Dioxide Sensor and Transmitter: Single detectors using solid-state infrared sensors; suitable over a temperature range of 23 to 130 deg F and calibrated for 0 to 2 percent, with continuous or averaged reading, 4- to 20-mA output; for wall mounting.

C. Oxygen Sensor and Transmitter: Single detectors using solid-state zircon cell sensing; suitable over a temperature range of minus 32 to plus 1100 deg F and calibrated for 0 to 5 percent, with continuous or averaged reading, 4- to 20-mA output; for wall mounting.

D. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment; for flush mounting.

## 2.9 THERMOSTATS

### A. Manufacturers:

1. Same as Direct Digital Controller Manufacturer.

B. Combination Thermostat and Fan Switches: Line-voltage thermostat with push-button or lever-operated fan switch.

1. Label switches "FAN ON-OFF".
2. Mount on single electric switch box.

- C. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.
- D. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.
  - 1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.
  - 2. Selector Switch: Integral, manual on-off-auto.
- E. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.
  - 1. Bulbs in water lines with separate wells of same material as bulb.
  - 2. Bulbs in air ducts with flanges and shields.
  - 3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.
  - 4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
  - 5. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.
  - 6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.
- F. Fire-Protection Thermostats: Listed and labeled by an NRTL acceptable to authorities having jurisdiction; with fixed or adjustable settings to operate at not less than 75 deg F above normal maximum operating temperature, and the following:
  - 1. Reset: Manual.
  - 2. Reset: Automatic, with control circuit arranged to require manual reset at central control panel; with pilot light and reset switch on panel labeled to indicate operation.
- G. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.
- H. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.
- I. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic- reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.
  - 1. Bulb Length: Minimum 20 feet.
  - 2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

- J. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic- reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above set point.
  - 1. Bulb Length: Minimum 20 feet.
  - 2. Quantity: One thermostat for every 20 sq. ft. of coil surface.
- K. Heating/Cooling Valve-Top Thermostats: Proportional acting for proportional flow, with molded-rubber diaphragm, remote-bulb liquid-filled element, direct and reverse acting at minimum shutoff pressure of 25 psig, and cast housing with position indicator and adjusting knob.
- L. Thermostats shall be provided by the Temperature Control Subcontractor and compatible with the BAS. Night setback and thermostat settings shall be controlled by BAS.

## 2.10 HUMIDISTATS

- A. Manufacturers:
  - 1. MAMAC Systems, Inc.
  - 2. ROTRONIC Instrument Corp.
- B. Duct-Mounting Humidistats: Electric insertion, 2-position type with adjustable, 2 percent throttling range, 20 to 80 percent operating range, and single- or double-pole contacts.

## 2.11 ACTUATORS

- A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
  - 1. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
  - 2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
  - 3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. X lbf and breakaway torque of 300 in. X lbf.
  - 4. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. X lbf.
  - 5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. X lbf and breakaway torque of 300 in. X lbf.
  - 6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. X lbf.

- B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
1. Manufacturers:
    - a. Schneider Electric.
  2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
  3. Dampers: Size for running torque calculated as follows:
    - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
    - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
    - c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
    - d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
    - e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
    - f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
  4. Coupling: V-bolt and V-shaped, toothed cradle.
  5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
  6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
  7. Power Requirements (Two-Position Spring Return): 24-V ac.
  8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
  9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
  10. Temperature Rating: Minus 22 to plus 122 deg F.
  11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
  12. Run Time: 12 seconds open, 5 seconds closed.

## 2.12 CONTROL VALVES

- A. Manufacturers:
1. Schneider Electric.
  2. Siemens.
  3. Honeywell.
- B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
- C. Hydronic system globe valves shall have the following characteristics:
1. NPS 2 and Smaller: Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
  2. NPS 2-1/2 and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.



3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.
    - a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
    - b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.
  4. Sizing: 3-psig maximum pressure drop at design flow rate or the following:
    - a. Two Position: Line size.
    - b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
    - c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.
  5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
  6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.
- D. Butterfly Valves: 200-psig, 150-psig maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
1. Body Style: Wafer.
  2. Disc Type: Aluminum bronze.
  3. Sizing: 1-psig maximum pressure drop at design flow rate.

## 2.13 DAMPERS

- A. Manufacturers:
1. Air Balance Inc.
  2. Don Park Inc.; Autodamp Div.
  3. TAMCO (T. A. Morrison & Co. Inc.).
  4. United Enertech Corp.
  5. Vent Products Company, Inc.
- B. Dampers: AMCA-rated, opposed-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.
1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with oil-impregnated sintered bronze blade bearings, blade-linkage hardware of zinc-plated

steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.

2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. X lbf; when tested according to AMCA 500D.

#### 2.14 CONTROL CABLE

- A. Electronic and fiber-optic cables for control wiring are specified in Division 27 Section "Communications Horizontal Cabling."

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that conditioned power supply is available to control units and operator workstation.
- B. Verify that pneumatic piping and duct-, pipe-, and equipment-mounted devices are installed before proceeding with installation.

#### 3.2 INSTALLATION

- A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.
- B. Connect and configure equipment and software to achieve sequence of operation specified.
- C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above the floor.
  1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- D. Install guards on thermostats in the following locations:
  1. Entrances.
  2. Public areas.
  3. Where indicated.
- E. Install automatic dampers according to Division 23 Section "Air Duct Accessories."

- F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
- G. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."
- H. Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."
- I. Install refrigerant instrument wells, valves, and other accessories according to Division 23 Section "Refrigerant Piping."
- J. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.
- K. Install electronic and fiber-optic cables according to Division 27 Section "Communications Horizontal Cabling."

### 3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."
- B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Install signal and communication cable according to Division 27 Section "Communications Horizontal Cabling."
  - 1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
  - 2. Install exposed cable in raceway.
  - 3. Install concealed cable in raceway.
  - 4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
  - 5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
  - 6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
  - 7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
- D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
  - 2. Test and adjust controls and safeties.
  - 3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
  - 4. Test each point through its full operating range to verify that safety and operating control set points are as required.
  - 5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
  - 6. Test each system for compliance with sequence of operation.
  - 7. Test software and hardware interlocks.
- C. DDC Verification:
  - 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
  - 2. Check instruments for proper location and accessibility.
  - 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
  - 4. Check instrument tubing for proper fittings, slope, material, and support.
  - 5. Check installation of air supply for each instrument.
  - 6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
  - 7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
  - 8. Check temperature instruments and material and length of sensing elements.
  - 9. Check control valves. Verify that they are in correct direction.
  - 10. Check DDC system as follows:
    - a. Verify that DDC controller power supply is from emergency power supply, if applicable.
    - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
    - c. Verify that spare I/O capacity has been provided.
    - d. Verify that DDC controllers are protected from power supply surges.
- D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

### 3.5 ADJUSTING

#### A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:
  - a. Check analog inputs at 0, 50, and 100 percent of span.
  - b. Check analog outputs using milliamper meter at 0, 50, and 100 percent output.
  - c. Check digital inputs using jumper wire.
  - d. Check digital outputs using ohmmeter to test for contact making or breaking.
  - e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
5. Flow:
  - a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
  - b. Manually operate flow switches to verify that they make or break contact.
6. Pressure:
  - a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
  - b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
7. Temperature:
  - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
  - b. Calibrate temperature switches to make or break contacts.
8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

- B. Adjust initial temperature and humidity set points.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

END 23 0900

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Double-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.
7. Louvers.
8. Fabric duct.
9. Single-wall round ducts and fittings.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."



## 2.2 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Lindab Inc.
  2. McGill AirFlow LLC.
  3. SEMCO Incorporated.
  4. Sheet Metal Connectors, Inc.
  5. Lapine Metal Products
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.
- C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
    - a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
  2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
    - a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
    - b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
  3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch- diameter perforations, with overall open area of 23 percent.
- E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Cover insulation with polyester film complying with UL 181, Class 1.

## 2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  1. Galvanized Coating Designation: G60.
  2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
  1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.4 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CertainTeed Corporation; Insulation Group.
    - b. Johns Manville.
    - c. Knauf Insulation.
    - d. Owens Corning.
  2. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

## 2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
  2. Tape Width: 4 inches.
  3. Sealant: Modified styrene acrylic.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  7. Service: Indoor and outdoor.
  8. Service Temperature: Minus 40 to plus 200 deg F.
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
- C. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
  2. Solids Content: Minimum 65 percent.
  3. Shore A Hardness: Minimum 20.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. VOC: Maximum 75 g/L (less water).
  7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  8. Service: Indoor or outdoor.
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
  10. VOC: Maximum 395 g/L.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
  2. Type: S.
  3. Grade: NS.
  4. Class: 25.
  5. Use: O.
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

## 2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
  1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

## 2.7 LOUVERS

- A. Provide and install extruded aluminum louvers in walls as shown on drawings and as specified herein.
- B. Intake louvers shall be 4" deep double hook design arranged to permit bottom of duct to hook over bottom blade for drainage to outside.
- C. Louvers in other walls shall have wall flange on sides, top and bottom.
- D. All louvers shall be constructed of minimum .081 extrusions, with reinforcing bosses and bars as required.
- E. Furnish 5/8" mesh removable bird screens on inside of all louvers, constructed of .063 wire with extruded frames.
- F. Louvers shall have color anodized finish. Final louver finish shall be selected by Architect/Engineer at shop drawing review stage. Submit color samples with shop drawings.
- G. All louvers shall have AMCA rating and label. The manufacturer shall furnish air pressure loss and water penetration data with all submittals.

- H. Acceptable manufacturers: Air Balance Inc., Chicago, Illinois; The Airolite Co., Marietta, Ohio; American Warming and Vent Co., Inc., Toledo, Ohio; Arrow United, Long Island City, New York; and Vent Products Co., Inc., Chicago, Illinois. Ruskin.
- I. Provide insulated panels to blank off unused portion(s) of louvers not used for ducted connections:
  - 1. Panels shall be insulated with 1" thick rigid closed cell foam enclosed in 22 gage (minimum) sheet metal.
  - 2. Prime panels with rust-resistant paint, color selected by Architect.
  - 3. Panels shall be anodized aluminum in color to match louver.
- J. Forward shop drawing submittals to the Architect/Engineer for review.

## 2.8 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards".
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Lindab Inc.
    - b. McGill AirFlow LLC.
    - c. SEMCO Incorporated.
    - d. Sheet Metal Connectors, Inc.
    - e. Spiral Manufacturing Co., Inc.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards", "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards", "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
  - 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards", "90 Degree Tees and Laterals", "Conical Tees", for static-pressure class, applicable

sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## PART 3 - EXECUTION

### 3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. All ducts shall be of size indicated on the drawings. In no case shall the indicated duct size be changed without written approval of the Architect / Engineer.
- C. Duct sizes shown on drawings are met inside area. Where duct lining is specified, increase duct sizes to allow for lining.
- D. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- E. Install round and flat-oval ducts in maximum practical lengths.
- F. Install ducts with fewest possible joints.
- G. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- H. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- I. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- J. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- K. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- L. Where ducts pass through non-fire rated interior partitions, seal around duct with non-combustible material.
- M. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal

flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

- N. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- O. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

### 3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.
- F. Support all horizontal ducts up to 46" wide with field punched steel strap hangers, sized per SMACNA, placed down side, turned under bottom of ducts and securely fastened to the building construction in an approved manner. Ducts from 47" up to 70" wide shall have 1.50" x 1.50" x 3/16" angle iron trapeze hangers with 3/8" diameter rods attached to building construction. Ducts from 71" up to 118" wide shall have 2.50" x 2" x 5/16" angle iron trapeze hangers with 1/2" diameter rods attached to building construction. Space horizontal duct supports not more than 8'-0" apart. All hangers and stiffeners shall be galvanized steel.
- G. No piping, conduit, ceiling supports or any other building element shall be suspended from duct supports.
- H. Carefully check the arrangement of ducts and dimensions of all working spaces at the building so that there will be no interference with the running of ducts. Carefully lay out all openings in floors and walls.
- I. Increase duct sizes gradually, not exceeding 15 divergence or convergence in duct runs.
- J. Where plenum-type takeoffs or runouts are shown and at all flex duct connections to rectangular ducts, the area of opening into main duct shall be a minimum of 150% of branch duct area.

### 3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 2. Outdoor, Supply-Air Ducts: Seal Class A.
  - 3. Outdoor, Exhaust Ducts: Seal Class C.
  - 4. Outdoor, Return-Air Ducts: Seal Class C.
  - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
  - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
  - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
  - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
  - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
  - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
  - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
  - 12. Conditioned Space, Return-Air Ducts: Seal Class C.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.



- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### 3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.6 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

### 3.7 START UP

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

### 3.8 DUCT SCHEDULE

- A. Supply Ducts:
  - 1. Ducts Connected to Fan Coil Units, Heat Pumps, and Terminal Units:
    - a. Pressure Class: Positive 2-inch wg.
    - b. Minimum SMACNA Seal Class: B.
    - c. SMACNA Leakage Class for Rectangular: 12.
    - d. SMACNA Leakage Class for Round and Flat Oval: 12.
  - 2. Ducts Connected to Constant-Volume Air-Handling Units:
    - a. Pressure Class: Positive 3-inch wg.
    - b. Minimum SMACNA Seal Class: A.
    - c. SMACNA Leakage Class for Rectangular: 6.
    - d. SMACNA Leakage Class for Round and Flat Oval: 6.

B. Return Ducts:

1. Ducts Connected to Fan Coil Units, Heat Pumps, and Terminal Units:

- a. Pressure Class: Positive or negative 2-inch wg.
- b. Minimum SMACNA Seal Class: B.
- c. SMACNA Leakage Class for Rectangular: 12.
- d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Air-Handling Units:

- a. Pressure Class: Positive or negative 2-inch wg.
- b. Minimum SMACNA Seal Class: B.
- c. SMACNA Leakage Class for Rectangular: 6.
- d. SMACNA Leakage Class for Round and Flat Oval: 6.

C. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

- a. Pressure Class: Negative 2-inch wg.
- b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
- c. SMACNA Leakage Class for Rectangular: 12.
- d. SMACNA Leakage Class for Round and Flat Oval: 6.

2. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.

- a. Exposed to View: Type 304, 14 gauge, stainless-steel sheet, No. 4 finish.
- b. Concealed: Type 304, stainless-steel sheet, No. 2D finish or 14 gauge carbon steel sheet.
- c. Welded seams and joints.
- d. Pressure Class: Positive or negative 3-inch wg.
- e. SMACNA Leakage Class: 3.

D. Liner:

- 1. Return Air Ducts (Where Shown on the Drawings): Fibrous glass, Type I, 1 inch thick.
- 2. Exhaust / Relief Ducts (Where Shown on the Drawings): Fibrous glass, Type I, 1 inch thick.

E. Elbow Configuration:

- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
  - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
  - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

- c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
  - 2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
    - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
      - 1) Radius-to Diameter Ratio: 1.5.
    - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
    - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam or welded.
- F. Exposed Ductwork in Finished Areas:
  - 1. Exposed round ductwork to be double wall insulated.
  - 2. Exposed rectangular ductwork to be board insulated and paintable.

END 23 3113

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. HVAC Contractor: Work includes the following:
  - a. Packaged, air-cooled, refrigerant compressor and condenser units.

1.2 RELATED WORK

A. Specified elsewhere:

1. 23 05 53 - Identification for HVAC Piping and Equipment
2. 23 09 00 - Instrumentation and Control for HVAC
3. 23 09 93 - Sequence of Operations for HVAC Controls

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For compressor and condenser units. Include plans, elevations, sections, details, and attachments to other work.
  1. Wiring Diagrams: For power, signal, and control wiring.
  2. Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Standard for Refrigeration Systems."

## 1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of compressor and condenser units that fail in materials or workmanship within specified warranty period.
1. Failures include the following:
    - a. Compressor failure.
    - b. Condenser coil leak.
  2. Warranty Period (Compressor Only Including Parts and Labor): Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 COMPRESSOR AND CONDENSER UNITS, AIR COOLED

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
1. Carrier Corporation; Commercial HVAC Systems.
  2. Daikin.
  3. Trane.
- B. Description: Factory assembled and tested; consisting of compressor, condenser coil, fan, motors, refrigerant reservoir, and operating controls.
- C. Compressor: Scroll, hermetically sealed, with rubber vibration isolators.
1. Motor: Single speed, and includes thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
- D. Refrigerant: R-410A.
- E. Condenser Coil: Seamless copper-tube, aluminum-fin coil; circuited for integral liquid subcooler, with removable drain pan and brass service valves with service ports.
- F. Condenser Fan: Direct-drive, aluminum propeller fan; with permanently lubricated, totally enclosed fan motor with thermal-overload protection.
- G. Accessories:
1. Crankcase heater.
  2. Cycle Protector: Automatic-reset timer to prevent rapid compressor cycling.
  3. Electronic programmable thermostat to control compressor and condenser unit and evaporator fan.

4. Filter-dryer.
  5. High-Pressure Switch: Automatic-reset switch cycles compressor off on high refrigerant pressure.
  6. Low-Pressure Switch: Automatic-reset switch cycles compressor off on low refrigerant pressure.
  7. PE mounting base.
  8. Precharged and insulated suction and liquid tubing.
  9. Thermostatic expansion valve.
  10. Time-Delay Relay: Continues operation of evaporator fan after compressor shuts off.
- H. Unit Casing: Galvanized steel, finished with baked enamel; with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Mount service valves, fittings, and gage ports on exterior of casing.

## 2.2 SOURCE QUALITY CONTROL

- A. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," Section 6, "Heating, Ventilating, and Air-Conditioning."
- B. Testing Requirements: Factory test sound-power-level ratings according to ARI 270.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install units level and plumb, firmly anchored in locations indicated.
- B. Install roof-mounting units on equipment supports specified in Section 077200 "Roof Accessories."
- C. Maintain manufacturer's recommended clearances for service and maintenance.
- D. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

### 3.2 CONNECTIONS

- A. Comply with requirements for piping in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Section 15179 "Hydronic Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

- C. Connect precharged refrigerant tubing to unit's quick-connect fittings. Install tubing so it does not interfere with access to unit. Install furnished accessories.
- D. Connect refrigerant piping to air-cooled compressor and condenser units; maintain required access to unit. Install furnished field-mounted accessories.
- E. Perform tests and inspections and prepare test reports.
- F. Tests and Inspections:
  - 1. Comply with ASME B31.5, Chapter VI.
  - 2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
  - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
    - a. Fill system with nitrogen to the required test pressure.
    - b. System shall maintain test pressure at the manifold gage throughout duration of test.
    - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

### 3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.
  - 2. Leak Test: After installation, charge system with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor operation and unit operation, product capability, and compliance with requirements.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 5. Verify proper airflow over coils.
- C. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

### 3.4 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss,

expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Refer to Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls" for control wiring, and sequence of operation.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- M. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- N. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- O. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."
- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."



- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

### 3.5 PIPE JOINT CONSTRUCTION

- A. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- B. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
  - 1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
  - 2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

### 3.6 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
  - 1. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
  - 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
  - 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.

### 3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
  - 1. Install core in filter dryers after leak test but before evacuation.
  - 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
  - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
  - 4. Charge system with a new filter-dryer core in charging line.

### 3.8 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
  - 1. Open shutoff valves in condenser water circuit.
  - 2. Verify that compressor oil level is correct.
  - 3. Open compressor suction and discharge valves.
  - 4. Open refrigerant valves except bypass valves that are used for other purposes.
  - 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END 23 6200

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. HVAC Contractor: Provide and install air handling systems as shown on the drawings and as specified. Work includes, but is not limited to, the following:
  - a. Air handling units and rooftop units
  - b. Fans and accessories

B. Work Not Included:

1. Materials, equipment or final connections to items of equipment specified or noted on the drawings to be furnished or executed under another contract.

1.2 RELATED WORK

A. Specified elsewhere:

1. Sections: Architectural / Structural and General Work
2. Division 23 - Mechanical Systems

1.3 QUALITY ASSURANCE

- A. Use only new material and apparatus of the specified design and manufacturer. Furnish all materials in accordance with latest ANSI, ASTM, NFPA, AMCA, SMACNA, ASHRAE, UL, MICA, AABC, ARI, ADC standards and other applicable standards or codes.

1.4 SUBMITTALS

- A. See Architectural Sections for requirements.

PART 2 - PRODUCTS

2.1 AIR HANDLING UNITS AND ROOFTOP UNITS

A. Unit Casing

1. Unit manufacturer shall ship unit in segments as specified by the contractor for ease of installation in tight spaces. The entire air handler shall be constructed of galvanized steel. Casing finished to meet ASTM B117 250-hour salt-spray test. The removal of access panels or access doors shall not affect the structural integrity of the unit. All removable panels shall be gasketed. All doors shall have gasketing around full perimeter to prevent air leakage. Contractor shall be

responsible to provide connection flanges and all other framework that is needed to properly support the unit.

2. Casing performance - Casing air leakage shall not exceed leak class 6 (CL = 6) per ASHRAE 111 at specified casing pressure, where maximum casing leakage (cfm/100 ft<sup>2</sup> of casing surface area) = CL X P<sup>0.65</sup>.
3. Air leakage shall be determined at 1.00 times maximum casing static pressure up to 8 inches w.g. Specified air leakage shall be accomplished without the use of caulk. Total estimated air leakage shall be reported for each unit in CFM, as a percentage of supply air, and as an ASHRAE 111 Leakage Class.
4. Under 55F supply air temperature and design conditions on the exterior of the unit of 81F dry bulb and 73F wet bulb, condensation shall not form on the casing exterior. The AHU manufacturer shall provide tested casing thermal performance for the scheduled supply air temperature plotted on a psychrometric chart. The design condition on the exterior of the unit shall also be plotted on the chart. If tested casing thermal data is not available, AHU manufacturer shall provide, in writing to the Engineer and Owner, a guarantee against condensation forming on the unit exterior at the stated design conditions above. The guarantee shall note that the AHU manufacturer will cover all expenses associated with modifying units in the field should external condensate form on them. In lieu of AHU manufacturer providing a written guarantee, the installing contractor must provide additional external insulation on AHU to prevent condensation.
5. Unit casing (wall/floor/roof panels and doors) shall be able to withstand up to 1.5 times design static pressure, or 8-inch w.g., whichever is less, and shall not exceed 0.0042 per inch of panel span (L/240).
6. Floor panels shall have tread plate flooring - aluminum tread plate minimum 0.125".
7. Unit casing panels shall be 2-inch double-wall construction, with solid galvanized exterior and solid galvanized interior, to facilitate cleaning of unit interior.
8. Unit casing panels (roof, walls, floor) and doors shall be provided with a minimum thermal resistance (R-value) of 13 Hr\*Ft<sup>2</sup>\*°F/BTU.
9. Unit casing panels (roof, walls, floor) and external structural frame members shall be completely insulated filling the entire panel cavity in all directions so that no voids exist. Panel insulation shall comply with NFPA 90A.
10. Casing panel inner liners must not extend to the exterior of the unit or contact the exterior frame. A mid-span, no-through-metal, internal thermal break shall be provided for all unit casing panels.
11. Access panels and/or access doors shall be provided in all sections to allow easy access to drain pan, coil(s), motor, drive components and bearings for cleaning, inspection, and maintenance.
12. Access panels and doors shall be fully removable without the use of specialized tools to allow complete access of interior surfaces.
13. The fan section and discharge plenum section shall have 2" of additional insulation and perforated liner for sound attenuation.

#### B. Access Doors

1. Access doors shall be 2-inch double-wall construction. Interior and exterior shall be of the same construction as the interior and exterior wall panels.
2. All doors downstream of the cooling coil shall be provided with a thermal break construction of door panel and door frame.

3. Gasketing shall be provided around the full perimeter of the doors to prevent air leakage.
4. Door hardware shall be surface-mounted to prevent through-cabinet penetrations that could likely weaken the casing leakage and thermal performance.
5. Handle hardware shall be designed to prevent unintended closure.
6. Access doors shall be hinged and removable without the use of specialized tools to allow.
7. Hinges shall be interchangeable with the door handle hardware to allow for alternating door swing in the field to minimize access interference due to unforeseen job site obstructions.
8. Door handle hardware shall be adjustable and visually indicate locking position of door latch external to the section.
9. All doors shall be a 60-inch high when sufficient unit height is available, or the maximum height allowed by the unit height.
10. Multiple door handles shall be provided for each latching point of the door necessary to maintain the specified air leakage integrity of the unit.

C. Primary Drain Pans

1. All cooling coil sections shall be provided with an insulated, double-wall, stainless steel drain pan.
2. The drain pan shall be designed in accordance with ASHRAE 62.1 being of sufficient size to collect all condensation produced from the coil and sloped in two planes, pitched toward drain connections, promoting positive drainage to eliminate stagnant water conditions when unit is installed level and trapped per manufacturer's requirements. See section 2.07, paragraph F through H for specifications on intermediate drain pans between cooling coils.
3. The outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition.
4. All drain pan threaded connections shall be visible external to the unit. Threaded connections under the unit floor shall not be accepted.
5. Drain connections shall be of the same material as the primary drain pan and shall extend a minimum 2-1/2-inch beyond the base to ensure adequate room for field piping of condensate traps.
6. The installing contractor is responsible to ensure the unit is installed level, trapped in accordance with the manufacturer's requirements, and visually inspected to ensure proper drainage of condensate.
7. Coil support members inside the drain pan shall be of the same material as the drain pan and coil casing.
8. If drain pans are required for heating coils, access sections, or mixing sections they will be indicated in the plans.

D. Fans

1. Fan sections shall have a minimum of one hinged and latched access door located on the drive side of the unit to allow inspection and maintenance of the fan, motor, and drive components. Construct door(s) per Section 2.04.

2. Provide fans of type and class as specified on the schedule. Fan shafts shall be solid steel, coated with a rust-inhibiting coating, and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM. All fans shall be statically and dynamically tested by the manufacturer for vibration and alignment as an assembly at the operating RPM to meet design specifications. Fans controlled by variable frequency drives shall be statically and dynamically tested for vibration and alignment at speeds between 25% and 100% of design RPM. If fans are not factory-tested for vibration and alignment, the contractor shall be responsible for cost and labor associated with field balancing and certified vibration performance. Fan wheels shall be keyed to fan shafts to prevent slipping.
3. All fans, including direct drive plenum fans, shall be mounted on isolation bases. Internally-mounted motor shall be on the same isolation base. Fan and motor shall be internally isolated with spring isolators. Unit sizes up to a nominal 4,000 CFM shall have 1-inch spring isolation. Units with nominal CFM's higher than 4,000 shall have 2-inch springs. A flexible connection (e.g. canvas duct) shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor in order to avoid transmission of noise and vibration through the ductwork and building structure.

#### E. Motors and Drives

1. All motors and drives shall be factory-installed and run tested. All motors shall be installed on a slide base to permit adjustment of belt tension. Slide base shall be designed to accept all motor sizes offered by the air-handler manufacturer for that fan size to allow a motor change in the future, should airflow requirements change. Fan sections without factory-installed motors shall have motors field installed by the contractor. The contractor shall be responsible for all costs associated with installation of motor and drive, alignment of sheaves and belts, run testing of the motor, and balancing of the assembly.
2. Motors shall meet or exceed all NEMA Standards Publication MG 1 - 2006 requirements and comply with NEMA Premium efficiency levels when applicable. Motors shall comply with applicable requirements of NEC and shall be UL Listed.
3. Fan Motors shall be heavy duty, open drip-proof operable at 460 volts, 60Hz, 3-phase. If applicable, motor efficiency shall meet or exceed NEMA Premium efficiencies.
4. Direct driven fans shall use 2-pole (3600 rpm), 4-pole (1800 rpm) or 6-pole (1200 rpm) motors, NEMA Design B, with Class B insulation capable to operate continuously at 104 deg F (40 deg C) without tripping overloads.
5. Motors shall have a +/- 10 percent voltage utilization range to protect against voltage variation.
6. Manufacturer shall provide for each fan a nameplate with the following information to assist air balance contractor in start up and service personnel in maintenance. Fan and motor sheave part number. Fan and motor bushing part number. Number of belts and belt part numbers. Fan design RPM and motor HP. Belt tension and deflection. Center distance between shafts

## F. Coils

1. Coils section header end panel shall be removable to allow for removal and replacement of coils without impacting the structural integrity of the unit.
2. Install coils such that headers and return bends are enclosed by unit casing to ensure that if condensate forms on the header or return bends, it is captured by the drain pan under the coil.
3. Coils shall be manufactured with plate fins to minimize water carryover and maximize airside thermal efficiency. Fin tube holes shall have drawn and belled collars to maintain consistent fin spacing to ensure performance and air pressure drop across the coil as scheduled. Tubes shall be mechanically expanded and bonded to fin collars for maximum thermal conductivity. Use of soldering or tinning during the fin-to-tube bonding process is not acceptable due to the inherent thermal stress and possible loss of bonding at that joint.
4. Construct coil casings of galvanized steel. End supports and tube sheets shall have belled tube holes to minimize wear of the tube wall during thermal expansion and contraction of the tube.
5. All coils shall be completely cleaned prior to installation into the air handling unit. Complete fin bundle in direction of airflow shall be degreased and steam cleaned to remove any lubricants used in the manufacturing of the fins, or dirt that may have accumulated, in order to minimize the chance for water carryover.
6. ½" tube coils shall have minimum tube thickness of 0.025" and 5/8" tubes shall have minimum tube thickness of 0.024".
7. When two or more cooling coils are stacked in the unit, an intermediate drain pan shall be installed between each coil. The intermediate drain pan shall be designed being of sufficient size to collect all condensation produced from the coil and sloped to promote positive drainage to eliminate stagnant water conditions. The intermediate drain pan shall be constructed of the same material as the sections primary drain pan.
8. The intermediate drain pan shall begin at the leading face of the water-producing device and be of sufficient length extending downstream to prevent condensate from passing through the air stream of the lower coil.
9. Intermediate drain pan shall include downspouts to direct condensate to the primary drain pan. The intermediate drain pan outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition.

## G. Filters

1. Provide factory-fabricated filter section of the same construction and finish as unit casings. Filter section shall have side access filter guides and access door(s) extending the full height of the casing to facilitate filter removal. Construct doors in accordance with Section 2.04. Provide fixed filter blockoffs as required to prevent air bypass around filters. Blockoffs shall not need to be removed during filter replacement. Filters to be of size, and quantity needed to maximize filter face area of each particular unit size.
2. Filter type, MERV rating, and arrangement shall be provided as defined in project plans and schedule
3. Manufacturer shall provide one set of startup filters. Provide two additional sets of filters. One set shall be installed at the completion of the project and the third

set shall be turned over to the Owner as a replacement set. Provide an exterior pressure gauge at the unit to check pressure drop across filters.

#### H. Dampers

1. All dampers, with the exception of external bypass and multizones (if scheduled), shall be internally mounted. Dampers shall be premium ultra low leak and located as indicated on the schedule and plans. Blade arrangement (parallel or opposed) shall be provided as indicated on the schedule and drawings. Dampers shall be Ruskin CD60 double-skin airfoil design or equivalent for minimal air leakage and pressure drop. Leakage rate shall not exceed 4 CFM/square foot at one inch water gauge complying with ASHRAE 90.1 maximum damper leakage and shall be AMCA licensed for Class 1A. All leakage testing and pressure ratings shall be based on AMCA Standard 500-D. Manufacturer shall submit brand and model of damper(s) being furnished, if not Ruskin CD60.

#### I. Hood Inlet

1. Inlet hoods for each outside damper shall be provided with a high performance sine-wave moisture eliminator to prevent entrainment of water into the unit from outside air. Wire mesh screens shall not be acceptable as a moisture eliminator. Exhaust hoods shall be provided on exhaust air openings.

#### J. Discharge Plenum Sections

1. Plenums shall be provided as indicated in the schedule and plans to efficiently turn air and provide acoustical attenuation. Discharge plenum opening types and sizes shall be scaled to meet pressure drop requirements scheduled and align with duct takeoffs. Provide additional 2" insulation and perforated liner for sound attenuation.
2. Provide grating over bottom opening for the unit.

#### K. Marine Lights

1. Marine lights shall be provided throughout AHUs as indicated on the schedule and plans. Lights shall be instant-on, light-emitting diode (LED) type to minimize amperage draw and shall produce lumens equivalent to a minimum 75W incandescent bulb (1200 lumens). LED lighting shall provide instant-on, white light and have a minimum 50,000 hr life.
2. Light fixture shall be weather-resistant, enclosed and gasketed to prevent water and dust intrusion.
3. Fixtures shall be designed for flexible positioning during maintenance and service activities for best possible location providing full light on work surface of interest and not being blocked by technician.
4. All lights on a unit shall be wired in the factory to a single on-off switch.
5. Installing contractor shall be responsible for providing 115V supply to the factory-mounted marine light circuit (unless single-point power is specified to be provided by AHU manufacturer).



L. Convenience Outlets

1. A 15-amp, 115V GFCI convenience outlet shall be provided by the AHU manufacturer. The outlet shall be separate from the load side of the equipment per NEC requirements. Installing contractor shall be responsible for providing 115V supply to the factory-mounted GFCI outlet circuit per NEC (even when single-point power is specified to be provided by AHU manufacturer).

M. Variable Frequency Drives (VFDs)

1. RTU VFDs to be factory installed. AHU variable frequency drives shall be provided, mounted, and wired by the Temperature Control Contractor as indicated on the schedule and drawings. All standard and optional features shall be included within the VFD enclosure, unless otherwise specified. The VFDs shall be UL listed. The listing shall allow mounting in plenum or other air handling compartments. Acceptable VFD manufacturers include: ABB, Square D and Dan Foss.
2. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to eliminate the need for motor derating.
3. With the motor's rated voltage applied to the VFD input, the VFD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.
4. The VFD shall include an input full-wave bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.
5. The VFD and options shall be tested to ANSI/UL Standard 508. The complete VFD, including all specified options, shall be assembled by the manufacturer, which shall be UL 508 certified for the building and assembly of option panels. Assembly of separate panels with options by a third-party is not acceptable. The appropriate UL stickers shall be applied to both the VFD and option panel, in the case where these are not contained in one panel.
6. The VFD shall have DC link reactors on both the positive and negative rails of the DC bus to minimize power line harmonics. VFDs without DC link reactors shall provide a minimum 3% impedance line reactor.
7. The VFDs full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.
8. The VFD shall be able to provide full torque at any selected frequency from 28 Hz to base speed to allow driving direct drive fans without derating.
9. An automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continually monitor the motor's speed and load and adjust the applied voltage to maximize energy savings and provide up to an additional 3% to 10% energy savings.

10. Input and output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD. Switching rate may be up to 1 time per minute on the input and unlimited on the output.
11. An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to run the test.
12. Galvanic and/or optical isolation shall be provided between the VFDs power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog I/O and discrete I/O shall include additional isolation modules.
13. The VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD efficiencies while reducing motor noise.
14. Protective Features
  - a. Protection shall be provided against input transients, loss of AC line phase, output short circuit, output ground fault, overvoltage, undervoltage, VFD overtemperature and motor overtemperature. The VFD shall display all faults as words. Codes are not acceptable.
  - b. The VFD shall be protected from sustained power or phase loss. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD shall continue to operate with reduced output with an input voltage as low as 164 V AC for 208/230 volt units, 313 V AC for 460 volt units, and 394 volts for 600 volts units.
  - c. The VFD shall incorporate a motor preheat circuit to keep the motor warm and prevent condensation build up in the stator.
  - d. The VFD package shall include semi-conductor rated input fuses to protect power components.
  - e. To prevent breakdown of the motor winding insulation, the VFD shall be designed to comply with IEC Part 34-17. Otherwise the AHU manufacturer shall ensure that inverter rated motors are supplied.
  - f. The VFD shall include a "signal loss detection" circuit to sense the loss of an analog input signal such as 4 to 20 mA or 2 to 10 V DC, and shall be programmable to react as desired in such an instance.
  - g. The VFD shall function normally when the keypad is removed while the VFD is running and continue to follow remote commands. No warnings or alarms shall be issued as a result of removing the keypad.
  - h. The VFD shall catch a rotating motor operating forward or reverse up to full speed.
  - i. The VFD shall be rated for 100,000 amp interrupting capacity (AIC).
  - j. The VFD shall include current sensors on all three output phases to detect and report phase loss to the motor. The VFD shall identify which of the output phases is low or lost.
  - k. The VFD shall continue to operate without faulting until input voltage reaches 300 V AC on 208/230 volt units, 539 V AC on 460 volt units, and 690 volts on 600 volt units.

## 15. Interface Features

- a. Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the VFD and determine the speed reference. On units with bypass, a VFD/Off/Bypass selector switch shall be provided.
- b. The VFD shall be able to be programmed to provide a 24 V DC output signal to indicate that the VFD is in Auto/Remote mode.
- c. The VFD shall provide digital manual speed control. Potentiometers are not acceptable.
- d. A lockable, alphanumeric backlit display keypad shall be provided. The keypad shall be remotely mountable up to 10 feet away using standard 9-pin cable.
- e. The keypads for all sizes of VFDs shall be identical and interchangeable.
- f. To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFDs keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters.
- g. The display shall be programmable to display in English, Spanish and French at a minimum.
- h. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.
- i. A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD eliminating the need for macros.
- j. The VFD shall include a standard EIA-485 communications port and capabilities to be connected at a future date to a Johnson Controls N2 Metasys or Siemens FLN system at no additional cost to the owner. The connection shall be software selectable by the user.
- k. At a minimum, the following points shall be controlled and/or accessible:
  - (1) VFD Start/Stop
  - (2) Speed reference
  - (3) Fault diagnostics
  - (4) Meter points
    - (a) Motor power in HP
    - (b) Motor power in kW
    - (c) Motor kW-hr
    - (d) Motor current
    - (e) Motor voltage
    - (f) Hours run
    - (g) 2 feedback signals
    - (h) DC link voltage
    - (i) Thermal load on motor
    - (j) Thermal load on VFD
    - (k) Heatsink temperature
- l. Four additional Form C 230 volt programmable relays shall be available for field installation within the VFD

- m. Two set-point control interfaces (PID control) shall be standard in the unit. The VFD shall be able to look at two feedback signals, compare with two set-points and make various process control decisions.
- n. Floating point control interface shall be provided to increase/decrease speed in response to contact closures.
- o. Four simultaneous displays shall be available. They shall include frequency or speed, run time, output amps and output power. VFDs unable to show these four displays simultaneously shall provide panel meters.
- p. Sleep mode shall be provided to automatically stop the VFD when its speed drops below set sleep level for a specified time. The VFD shall automatically restart when the speed command exceeds the set wake level.
- q. The sleep mode shall be functional in both follower mode and PID mode.
- r. A run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.
- s. The following displays shall be accessible from the control panel in actual units: Reference Signal Value, Output Frequency in Hz or percent, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, DC Bus Voltage, VFD Temperature in degrees, and unit CFM.
- t. The display shall be programmed to read in inches of water column (in-wg).
- u. The VFD shall be able to be programmed to sense the loss of load and signal a no load/broken belt warning or fault.
- v. If the temperature of the VFDs heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. If the temperature of the heat sink continues to rise the VFD shall automatically reduce its output frequency to the motor. As the VFDs heat sink temperature returns to normal, the VFD shall automatically increase the output frequency to the motor and return the carrier frequency to its normal switching speed.
- w. The VFD shall have temperature controlled cooling fans for quiet operation and minimized losses.
- x. The VFD shall store in memory the last 10 faults and related operational data.
- y. Eight programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
- z. Two programmable relay outputs, one Form C 240 V AC, one Form A 30 V AC, shall be provided for remote indication of VFD status.
- aa. Three programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include two voltage (0 to 10 V DC, 2 to 10 V DC) and one current (0 to 20 mA, 4 to 20 mA) input.
- bb. Two programmable 0 to 20 mA analog outputs shall be provided for indication of VFD status. These outputs shall be programmable for

output speed, frequency, current and power. They shall also be programmable to provide a selected 24V DC status indication.

- cc. Under fire mode conditions, the VFD shall be able to be programmed to automatically default to a preset speed.

#### 16. Adjustments

- a. The VFD shall have an adjustable carrier frequency in steps of not less than 0.1 kHz to allow tuning the VFD to the motor.
- b. A minimum of sixteen preset speeds shall be provided.
- c. Four acceleration and four deceleration ramps shall be provided. Accel and decel time shall be adjustable over the range from 0 to 3,600 seconds to base speed. The shape of these curves shall be automatically contoured to ensure no-trip acceleration and deceleration.
- d. Four current limit settings shall be provided.
- e. If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: undervoltage, overvoltage, current limit and inverter overload.
- f. The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.
- g. An automatic  $\zeta$ on delay $\zeta$  shall be selectable from 0 to 120 seconds.

#### 17. Service Conditions

- a. VFDs shall provide full output in an ambient temperature from -10 to 50°C (14 to 104°F).
- b. VFDs shall provide full output in a relative humidity from 0 to 95%, non-condensing.
- c. VFDs shall provide full output up to 3,300 feet elevation without derating.
- d. VFDs shall provide full output with an AC line voltage variation from -10 to +10% of nominal voltage.
- e. No side clearance shall be required for cooling of any units. All power and control wiring shall be done from the bottom.

#### 18. Warranty

- a. The VFD shall be warranted by the manufacturer for a period of 42 months from date of shipment, or 36 months from start-up, which ever occurs first. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory-authorized on-site service.

#### N. Factory Wiring of Lights, VFDs, and Combination Starters/Disconnects

- 1. VFDs shall be wired per NEC, UL, and NFPA 90A requirements. Units with factory-mounted controls shall also include power wiring from the VFD or starter/disconnect control transformer to the control system transformers. Units

with VFDs and factory-mounted controls shall have a binary start-stop signal and an analog speed signal wired from the direct digital controller to the VFD.

2. All power wiring for voltages greater than 24V and traveling through multiple unit sections shall be contained in an enclosed, metal, power-wiring raceway or EMT. Sections less than 6-inch in length may be contained in FMC.
3. The Temperature Control Contractor and RTU Manufacturer Service Technician shall unit for proper operation and fan rotation.
4. For fan motors not supplied with a factory mounted and wired starter or VFD, the unit manufacturer shall supply a 4 X 4 NEMA 4 junction box on the exterior of the fan section(s) with wiring, prewired to the fan motor, to allow for ease of field installation of a starter or VFD.
5. On units provided with factory mounted and wired supply fan starter or VFD and DDC controls, the manufacturer shall provide a single point of power. Line-to-24v transformers shall be provided with sufficient vA to power the unit mounted controller and factory installed control points.

O. Acceptable Manufacturers

1. Trane
2. York Solution YC
3. Carrier 39CC
4. Daikin Applied Skyline Series

P. Warranty

1. Provide comprehensive 3-year warranty including parts and labor.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install all equipment per manufacturer's printed recommendations.

### 3.2 EXAMINATION

- A. Verify that roof is ready to receive work.
- B. Verify that proper power supply is available.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Mount units on factory built roof mounting frame providing watertight enclosure to protect ductwork. Install roof mounting curb level.

### 3.4 MANUFACTURER'S FIELD SERVICES

- A. Package rooftop unitary manufacturers shall maintain service capabilities no more than 100 miles from the jobsite.

- B. The manufacturer shall furnish complete submittal wiring diagrams of the package unit as applicable for field maintenance and service.

END 23 8500

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section includes:
  - 1. Electrical equipment coordination and installation.
  - 2. Common electrical installation requirements.

PART 2 - PRODUCTS – DOES NOT APPLY

PART 3 - EXECUTION

3.1 INSPECTION OF BID DOCUMENTS AND PREMISES

- A. Visit the premises, take measurements and verify all elevations shown on the drawings, inspect existing conditions and limitations, obtain first hand information necessary to submit a complete bid.
- B. Thoroughly examine the complete set of contract documents including work required by other trades. Bidders are cautioned to acquaint themselves with requirements necessitating installation work of material or equipment furnished by other contractors or the Owner.
- C. In the event of any conflict, discrepancy or inconsistency among the Contract Documents, interpretation shall be based on the following descending order or priority:
  - 1. Specifications.
  - 2. Drawings, and among the drawings, the following:
    - a. as between figures given on drawings and scaled measurements, the figures shall govern;
    - b. as between large scale drawings and small scale drawings, the large scale drawings shall govern.



3. In the event that Work is called for by the drawings but not by the specifications, or by the specifications but not by the drawings, the Contractor shall be responsible for such Work.

### 3.2 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
  1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  3. To allow right of way for piping and conduit installed at required slope.
  4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

### 3.3 INTERRUPTION OF ELECTRICAL SYSTEMS AND SERVICES

- A. Do not interrupt electric systems or service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  1. Notify Architect or Owner no fewer than seven days in advance of proposed interruption of electrical service. Indicate:
    - a. The extent of the work to be done during the outage.
    - b. Probable length of time required for the outage.
    - c. Designed time at which the outage is to begin.
  2. Do not proceed with interruption of electrical service without Architect's or Owner's written permission.
  3. Schedule work to minimize the number and length of time of the outage(s) or interruption(s) of the various systems and services.

### 3.4 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Space Preference:
  - 1. Carefully verify and coordinate the location and level of all lines. Run preliminary levels and check with all other contractors so that conflict in location may be avoided.
  - 2. If conflicts occur, the following preference schedule shall be followed:
    - a. Recessed electric fixtures.
    - b. High pressure ductwork.
    - c. Sanitary drainage.
    - d. Steam condensate, hot and chilled water.
    - e. Low pressure ductwork.
    - f. Domestic water storm and vent lines.
    - g. Electric conduits.
  - 3. No other work shall have preference over plumbing lines below fixtures.
  - 4. No other work shall have preference over conduit above or below electric switchgear and above or below panels.
  - 5. No piping conveying fluids shall be provided directly over electrical or elevator equipment.
- F. Lines and Levels: Determine all grades, maintain necessary lines and levels throughout the progress of the work and assume full responsibility for their correctness. Where levels are indicated on the drawings, work shall be installed at those levels unless prior written approval to change is obtained from the Architect / Engineer.
- G. Location of Equipment: The approximate location of all equipment is shown on the drawings. The Architect / Engineer reserves the right to change the location of all equipment 5' in any direction without these changes being made the subject of an extra charge provided such changes are made before final installation.

### 3.5 ELECTRICAL DEMOLITION

- A. Disconnect and remove electrical systems, equipment and components indicated to be removed.
  - 1. Wiring Devices to be Removed: Remove wiring devices indicated to be removed along with associated cover plates.
  - 2. Electrical Equipment to be Removed: Remove electrical equipment indicated to be removed along with associated supports, fittings, raceways and conductors.
  - 3. Motors and Mechanical Equipment to be Removed: Electrically disconnect each motor and piece of mechanical equipment indicated to be removed and remove associated raceways, conduits, devices and electrical equipment.

4. Feeders and Branch Circuits to be Removed: Remove feeders and branch circuits indicated to be removed along with associated supports, fittings, raceway and conductors.
- B. All removed electrical equipment, devices, raceways, conductors and associated items, except as noted below, shall become property of the Contractor and shall be properly disposed of by the Contractor.
- C. Removal of existing electrical devices shall be such that all existing remaining electrical devices are kept in continuous service.
- D. Existing circuit conductors connected to outlets, boxes or fixtures being removed shall be disconnected and removed back to next active remaining device.
- E. Existing circuit conductors connected to other fixtures, devices or other electrical equipment that are not to be removed or disconnected and are passing through outlet boxes, fixtures and conduit that are being removed; shall be rerouted from remaining existing device to next remaining device as necessary to keep remaining devices in service and existing circuit conductors continuous.
- F. Where connections of existing devices cannot be made continuous with existing conduit, boxes and conductors; new raceways and conductors shall be installed from existing remaining device to next remaining device.
- G. For each item disconnected and removed, disconnect and remove defunct circuit wiring back to next active remaining device or to panel or switchboard from which the circuit originates.
- H. For each item disconnected and removed, disconnect and remove abandoned, exposed conduits, and / or conduits made exposed by demolition, back to next active remaining device or to panel or switchboard from which the circuit originates.
- I. All conditions shall be carefully field determined and verified.
- J. Provide all abandoned ceiling outlets, switch boxes and outlet boxes with blank coverplates.

### 3.6 CUTTING AND PATCHING

- A. Examine architectural and structural drawings to determine the general nature of the types of construction to be encountered during performance of electrical work.
- B. All cutting and patching of masonry, carpentry, steel, iron work, concrete structural work, and finished surfaces belonging to the building shall be done in order that work may be properly installed. Replace or repair all disturbed constructions or finishes to its original condition and under no condition cut structural work except upon approval of the Architect / Engineer.
- C. Cut through ceilings, floors, walls and partitions in a careful manner and fill the openings around the pipes and sleeves.

- D. Carefully coordinate locations of openings and sleeves to avoid conflict with other trades. Furnish complete information concerning locations and sizes of openings to other trades in sufficient time for inclusion on their shop drawings.
- E. Employ craftsmen and mechanics who are skilled and experienced in their respective trades to perform all cutting, fitting, matching, patch repairing, and finishing work required for installation of electrical work.
- F. Perform cutting to neat line, in a manner that will not weaken the wall, partition, or floor being cut. Cut holes in floors to neat line. Perform drilling in a manner that will not cause breaking of floor around the drilled hole.
- G. General Contractor shall patch, repair and unify all work and material that is cut.

### 3.7 OPENINGS IN EXISTING CONSTRUCTION

- A. In existing construction, perform all cutting and patching where required in connection with the work. Match patching to existing adjacent surfaces.
- B. All cutting in existing structural elements of building shall be accomplished with hole saws. Air hammers and cutting torches are not permitted.
- C. Reinforced concrete slabs, steel joists, concrete floors and footings, or other structural work shall not be cut or disturbed in any way, unless as approved by the Architect / Engineer. The Electrical Contractor shall be held responsible for and correct all damage that he may cause.
- D. Openings between conduit and floors or walls through fire or smoke barriers shall be closed with fire stop material to maintain fire or smoke barrier rating.
- E. Fire stop material shall be Dow Corning 3-6548 Silicone RTV Foam, Chase Technology Corp. CTC PR-855 fire-resistant foam sealant, 3M CP-25 Series Caulk Fire Barrier, T & B S-101 Fire Barrier or Nelson Flameseal.

### 3.8 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly.

### 3.9 FIREPROOFING REPAIR

- A. Install all hangers, inserts, supports, anchorages, etc., prior to installation of fireproofing materials. Do not remove or damage fireproofing on roof deck, roof beams, roof framing, floor beams of other floor framing members, columns, or wind bracing during installation of any electrical work. If fireproofing is damaged or is removed, repair or replace to satisfaction of Architect / Engineer and at no additional expense to Owner.

3.10 FIELD CORRECTIONS AND CHANGES

- A. Carefully and accurately record on field set of drawings, any deviations or changes in locations of conduit, wiring and/or equipment made in the field and shall keep the Architect / Engineer informed on all deviations and changes.
- B. At the completion of the job, furnish the Architect / Engineer three (3) complete sets (not the field set) of drawings indicating these deviations or changes. Extra sets of drawings will be provided to the contractor for this purpose. Any changes in the exterior work shall be recorded by dimension.

3.11 OPERATION AND MAINTENANCE INSTRUCTIONS

- A. Before final acceptance of the electrical installation, provide to the Architect / Engineer three (3) bound copies of a complete set of operating and maintenance instructions and procedures for all electrical systems and equipment furnished under this contract.
- B. Prepare a complete file of maintenance and operating instructions which covers all electrical systems and equipment listed in the section entitled "Submittals".
- C. Data shall be placed in an 8-1/2" x 11" slide hinge, heavy duty, three-post type, stiff cover binder. Each completed binder shall not exceed 3-1/2" in thickness. Label binder as follows:

ELECTRICAL SYSTEMS  
MAINTANENANCE AND OPERATING INSTRUCTIONS  
BROOKENS ADMINISTRATIVE CENTER  
HAIL DAMAGED HVAC REPLACEMENT  
URBANA, ILLINOIS

- D. Data shall include a complete table of contents, tabs, final approved shop drawings, wiring diagrams, manufacturer's operating and maintenance instructions, catalog brochure information, replacement parts lists, name, address and telephone number of nearest stocking supply house.
- E. Drawings shall be neatly folded to approximately 8-1/2" x 11" size and inserted individually into 8-1/2" x 11" sheet protectors which shall be properly punched and inserted into the binder.
- F. All material relative to the equipment for one system (i.e.; lighting fixtures, panelboards, motor starting equipment, etc.) shall be filed behind a clearly labeled filing tab. The following information shall be typed on the filing tab page: Item, Manufacturer, Contractor's Order Number, Supplier's Order Number, Manufacturer's Order Number.
- G. Three completed files shall be submitted for review prior to job completion. Final payments will not be certified until the maintenance manuals have been received and reviewed.

- H. Authorized manufacturer's personnel shall instruct (to the Owner's satisfaction) all personnel designated by the Owner in the use of equipment and systems as listed in the section entitled "Submittals".
- I. Provide a minimum of two man days in two trips to the job before the job is accepted for the instruction and training of the Owner's representative in the operation and maintenance of the complete electrical system.
- J. The above does not relieve the contractor of his responsibility of making service calls due to any defect which may develop with systems or equipment during the guarantee period nor shall these service calls be included as part of instruction time. Specific requirements in specifications for factor service representatives is also in addition to above requirements.

### 3.12 CLEANING UP

- A. Before work can be considered complete, clean all surfaces of all paint, plaster, mortar, labels and other stains and remove all lumps of cement. Take care not to scratch, mar, or damaged surfaces in cleaning.
- B. In case of dispute, the Owner / User may remove the rubbish and charge the cost to the one or more contractors as the Architect / Engineer may determine to be just.

END OF SECTION 26 0500

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Building wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. General Cable; General Cable Corporation.
  - 2. Senator Wire & Cable Company.
  - 3. Southwire Company.
  - 4. Nexans.
- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. 3M.
  - 2. Hubbell Power Systems, Inc.
  - 3. ILSCO.
  - 4. Tyco Electronics Corp.

- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
  - 1. Expandable steel spring and polypropylene body type connectors and wire nuts for wire sizes up to an including No. 10 AWG.
  - 2. Bolt type connectors or mechanical compression crimp type for wire sizes No. 8 AWG and larger. Cover connectors with three layers of 600 volt tape or heat shrinkable insulation equivalent to 150% conductor insulation.

### 2.3 SYSTEM DESCRIPTION

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

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- C. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
- E. Minimum wire size shall be No. 12 except for internal fixture wire which shall be minimum size of No. 14 type SF, SFF, PF, PFF or TFN, 600 volt.
- F. All branch circuit wiring and feeder cables for circuits over 20 amps shall be sized as noted on the drawings. If size is not specifically noted, size all branch circuit wiring and feeder cables in accordance with the National Electrical Code.



### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Splices and taps in conductors shall be as few in number as practicable.
- D. Splices and taps shall be so made that they have an electrical resistance not in excess of that of 2' of the conductor.
  - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- E. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.
- F. Neutral conductors in outlet boxes at receptacles shall be jointed and pigtailed to the outlet. The removal of a receptacle from the circuit shall not affect the continuity of the neutral conductor.

### 3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

### 3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

### 3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
  - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

END OF SECTION 26 0519

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment.
- B. Section includes grounding and bonding systems and equipment, plus the following special applications:
  - 1. Underground distribution grounding.
  - 2. Foundation steel electrodes.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Burndy; Part of Hubbell Electrical Systems.
  - 2. Dossert; AFL Telecommunications LLC.
  - 3. ERICO International Corporation.
  - 4. Fushi Copperweld Inc.
  - 5. Galvan Industries, Inc.; Electrical Products Division, LLC.
  - 6. Harger Lightning & Grounding.
  - 7. ILSCO.
  - 8. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - 9. Robbins Lightning, Inc.
  - 10. Siemens Power Transmission & Distribution, Inc.

## 2.2 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

## 2.3 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

## 2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

### 3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits. Separate grounding conductors are not shown on the drawings but shall be included in all raceways as set forth on the drawings.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70. Separate grounding conductors are not shown on the drawings but shall be included in all raceways as set forth on the drawings.
  - 1. Feeders and branch circuits.
  - 2. Receptacle circuits.
  - 3. Single-phase motor and appliance branch circuits.
  - 4. Three-phase motor and appliance branch circuits.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

### 3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

END OF SECTION 26 0526

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
    - a. Hangers.
    - b. Steel slotted support systems.
  - 2. Include rated capacities and furnished specialties and accessories.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
  - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
    - a. **Cooper B-Line, Inc.; a division of Cooper Industries.**
    - b. **Flex-Strut Inc.**
    - c. **Unistrut; an Atkore International company.**
  - 2. Material: Galvanized steel.

3. Channel Width: 1-5/8 inches.
  4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  5. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
  6. Channel Dimensions: Selected for applicable load criteria.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

### PART 3 - EXECUTION

#### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.
- B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  1. Secure raceways and cables to these supports with two-bolt conduit clamps.

#### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners. Anchors using explosive charges to drive inserts into concrete shall not be used.
  - 5. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69 or metal framing channel welded to structure.
  - 6. To Light Steel: Sheet metal screws.
  - 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.
- E. Repair fireproofing damaged as a result of installing clamps or supports to structural steel.

### 3.3 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.
- C. Prime paint all structural steel installed for pipe or equipment supports or burned by welding with one coat of rust inhibitive black paint at the time of installation.

END OF SECTION 26 0529



PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Metal conduits, tubing, and fittings.
  - 2. Surface raceways.
  - 3. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Allied Tube & Conduit; a part of Atkore International.
  - 2. Republic Conduit.
  - 3. Western Tube and Conduit Corporation.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.

- D. EMT: Comply with ANSI C80.3 and UL 797.
- E. FMC: Comply with UL 1; zinc-coated steel.
- F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
  - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
  - 2. Fittings for EMT:
    - a. Material: Steel.
    - b. Type: Compression.
  - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

## 2.2 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Technologies Company.
  - 2. Hubbell Incorporated.
  - 3. MonoSystems, Inc.
  - 4. RACO; Hubbell.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- F. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- G. Gangable boxes are prohibited.

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
3. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: EMT. Raceway locations include the following:
  - a. Loading dock.
  - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
  - c. Mechanical rooms.
  - d. Gymnasiums.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Damp or Wet Locations: GRC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
  - a. All boxes installed in poured concrete, block, brick or tile shall be masonry type.
  - b. All multiple gang switch boxes shall be solid gang box.
  - c. All surface-mounted boxes shall be cast FS or FD type.
  - d. The minimum size of boxes shall be 4" x 4" x 2-1/8" minimum depth. For single device installation, install square cut single device cover.
  - e. Install all device boxes with square cut device covers for number of devices required.
  - f. For multiple gang boxes installed for more than one 277 volt switch, a barrier shall be installed between each box gang.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.

### 3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Conduits and raceways shall not be supported from plumbing lines, ductwork or supports for equipment provided by other trades.
- F. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- G. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- J. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- K. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- L. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- M. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
  - 1. Use LFMC in damp or wet locations subject to severe physical damage.
  - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- N. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- O. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

### 3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

### 3.4 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

### 3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.
- B. Protect work from injury by keeping all conduit and boxes capped and plugged or otherwise protected. This includes damage by freezing and / or stoppage from building materials, sand, dirt or concrete.

END OF SECTION 26 0533

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
  - 2. Sleeve-seal systems.
  - 3. Grout.
  - 4. Silicone sealants.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Wall Sleeves:
  - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.2 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## 2.3 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
  - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
  - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
    - a. Seal annular space between sleeve and raceway or cable, using silicone sealant appropriate for size, depth, and location of joint.
    - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
  - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
  - 4. Install sleeves for all wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
  - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
  - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
  
- E. Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve-seal system.

END OF SECTION 26 0544



PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Identification for raceways.
  - 2. Equipment identification labels, including arc-flash warning labels.
  - 3. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

2.2 SIGNS

- A. Laminated Acrylic or Melamine Plastic Signs:
  - 1. Engraved legend.
  - 2. Thickness:
    - a. For signs up to 20 sq. inches, minimum 1/16-inch-.

- b. For signs larger than 20 sq. inches, 1/8 inch thick.
  - c. Engraved legend with black letters on white face.
  - d. Punched or drilled for mechanical fasteners.
  - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Brady Corporation.
  - b. Carlton Industries, LP.
  - c. emedco.

### 2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

### 3.2 IDENTIFICATION SCHEDULE

- A. Power-Circuit Conductor Identification, 600 V or Less:
  - 1. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

- a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
  - b. Colors for 208/120-V Circuits:
    - 1) Phase A: Black.
    - 2) Phase B: Red.
    - 3) Phase C: Blue.
    - 4) Neutral: White.
    - 5) Ground: Green.
  - c. Colors for 480/277-V Circuits:
    - 1) Phase A: Brown.
    - 2) Phase B: Orange.
    - 3) Phase C: Yellow.
    - 4) Neutral: White.
    - 5) Ground: Green with yellow stripe.
  - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- B. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.
- 1. Labeling Instructions:
    - a. Indoor Equipment: Engraved, laminated acrylic or melamine plastic label, punched or drilled for mechanical fasteners. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    - d. Fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
    - e. Attach labels with screws and not adhesives.
  - 2. Equipment To Be Labeled:
    - a. Access doors and panels for concealed electrical items.
    - b. Switchgear.
    - c. Motor-control centers.

- d. Enclosed switches.
- e. Enclosed circuit breakers.
- f. Enclosed controllers.
- g. Variable-speed controllers.
- h. Push-button stations.

END OF SECTION 26 0553

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. GFCI receptacles.

1.3 DEFINITIONS

- A. Abbreviations of Manufacturers' Names:
  - 1. Cooper: Cooper Wiring Devices; Division of Cooper Industries, Inc.
  - 2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
  - 3. Leviton: Leviton Mfg. Company, Inc.
  - 4. Pass & Seymour: Pass& Seymour/Legrand.
- B. BAS: Building automation system.
- C. EMI: Electromagnetic interference.
- D. GFCI: Ground-fault circuit interrupter.
- E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- F. RFI: Radio-frequency interference.
- G. SPD: Surge protective device.
- H. UTP: Unshielded twisted pair.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

## PART 2 - PRODUCTS

### 2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices for Owner-Furnished Equipment:
  - 1. Receptacles: Match plug configurations.
  - 2. Cord and Plug Sets: Match equipment requirements.
- D. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

### 2.2 GFCI RECEPTACLES

- A. General Description:
  - 1. 125 V, 20 A, straight blade, feed-through type.
  - 2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
  - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Duplex GFCI Convenience Receptacles:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Manufacturing Co., Inc.
    - d. Pass & Seymour/Legrand (Pass & Seymour).

### 2.3 FINISHES

- A. Device Color:

1. Wiring Devices Connected to Normal Power System: White unless otherwise indicated or required by NFPA 70 or device listing.
- B. The Architect / Engineer reserves the right to change the color at time of shop drawing review.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Mounting Heights
1. Examine architectural details and elevations for heights indicated there. Coordinate mounting heights with wall treatment and finish.
  2. Examine electrical drawings for heights indicated there.
  3. Unless otherwise indicated:
    - a. Wall Switches: 48" above finished floor, except where special wall treatment requires a higher or lower setting.
    - b. Dimmer and Lighting Controls: 48" AFF, except where special wall treatment requires higher or lower setting.
    - c. Receptacles - General: 18" AFF.
    - d. Receptacles in Mechanical and Electrical Equipment Rooms: 40" AFF.
    - e. Receptacles - Exterior: 24" above finished grade.
  4. Mounting heights given above shall be to the center line of the device.
  5. In block walls, locate device in either bottom or top of the block course nearest to the height indicated.
  6. In brick walls, mount receptacles in the horizontal position in the brick course nearest to the height indicated.
  7. Where receptacles are indicated to be installed above counters, mount in the horizontal position 4" from top of back splash to bottom of box.
- C. Coordination with Other Trades:
1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
  2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  4. Install wiring devices after all wall preparation, including painting, is complete.

D. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
  - a. Cut back and pigtail, or replace all damaged conductors.
  - b. Straighten conductors that remain and remove corrosion and foreign matter.
  - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

E. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

F. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.

G. Device Plates: Device plates shall fit tight against the finished walls and shall completely cover the openings in the walls for the boxes. Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening. Device plates shall be attached and adjusted so they finish straight and level.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.



- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

### 3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

### 3.3 GROUND FAULT INTERRUPTING RECEPTACLES

- A. Where drawing or specifications call for 15 amp or 20 amp, 120 volt receptacles in the following locations, provide ground fault interrupting type receptacles.
  - 1. Outdoors.

### 3.4 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
  - 1. Receptacles and Switches: Provide all outlet and switch coverplates with identification labels showing panelboard designation and circuit breaker number connected to device.
    - a. Normal Circuits: Black letters indicating panel and circuit number on clear background applied to front of coverplate. Minimum letter height 3/16".
    - b. Emergency Circuits: Red letter indicating panel and circuit number on clear background applied to front of coverplate. Minimum letter height 3/16".
  - 2. Labels shall be attached to coverplates with pressure-sensitive adhesive. Devices installed in multi-outlet, surface raceways shall be provided with labels.

END OF SECTION 26 2726

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Cartridge fuses rated 600 V ac and less for use in the following:
    - a. Control circuits.
    - b. Motor-control centers.
    - c. Panelboards.
    - d. Switchboards.
    - e. Enclosed controllers.
    - f. Enclosed switches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
  - 1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
    - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
    - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
  - 2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
  - 3. Current-limitation curves for fuses with current-limiting characteristics.
  - 4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit in PDF format.
  - 5. Coordination charts and tables and related data.
  - 6. Fuse sizes for elevator feeders and elevator disconnect switches.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.
  - 1. Ambient temperature adjustment information.
  - 2. Current-limitation curves for fuses with current-limiting characteristics.
  - 3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse used on the Project. Submit in PDF format.
  - 4. Coordination charts and tables and related data.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

#### 1.6 FIELD CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
  - 1. **Bussmann, an Eaton business.**
  - 2. **Edison; a brand of Bussmann by Eaton.**
  - 3. **Littelfuse, Inc.**
  - 4. **Mersen USA.**
- B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

#### 2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

1. Type RK-1: 250 or 600-V, zero- to 600-A rating, 200 kAIC, time delay.
  2. Type L: 600-V, 601- to 6000-A rating, 200 kAIC, time delay.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 FUSE APPLICATIONS

- A. Cartridge Fuses:
1. Feeders, 601 Amp through 6000 Amp: Class L, time delay.
  2. Feeders, up to 600 Amp: Class RK1, time delay.
  3. Motor Branch Circuits: Class RK1, time delay.
  4. Other Branch Circuits: Class RK1, time delay.
  5. Provide open-fuse indicator fuses or fuse covers with open fuse indication.

#### 3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

### 3.4 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 26 2813

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Molded-case circuit breakers (MCCBs).
  - 4. Molded-case switches.
  - 5. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 4. Include evidence of a nationally recognized testing laboratory (NRTL) listing for series rating of installed devices.
  - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF electronic format.

B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include wiring diagrams for power, signal, and control wiring.

## 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  - a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

## 1.6 FIELD CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

## 1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Source Limitations:

1. Obtain fusible switches, non-fusible switches, molded case circuit breakers and switches from the same manufacturer as:
  - a. Enclosed controllers.
  - b. Switchboards.
  - c. Distribution panelboards.
  - d. Branch circuit panelboards.
  - e. Motor control centers.
  - f. Enclosed busway.
  - g. Low voltage transformers.
  
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
  
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
  
- E. Comply with NFPA 70.

## 2.2 FUSIBLE SWITCHES

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
  1. Eaton.
  2. General Electric Company.
  3. Siemens Industry, Inc.
  4. Square D; by Schneider Electric.
  
- B. Type HD, Heavy Duty:
  1. Single throw.
  2. Three pole.
  3. 240 or 600-V ac as specified on drawings.
  4. 1200 A and smaller.
  5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
  6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
  
- C. Accessories:
  1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.



4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 24-V ac.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.

## 2.3 NONFUSIBLE SWITCHES

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
  1. Eaton.
  2. General Electric Company.
  3. Siemens Industry, Inc.
  4. Square D; by Schneider Electric.
- B. Type HD, Heavy Duty, Three Pole, Single Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
  1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  3. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 24-V ac.
  4. Lugs: Mechanical type, suitable for number, size, and conductor material.

## 2.4 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1) gray baked enamel paint, electrodeposited on cleaned, phosphatized galvanized steel (NEMA 250 Types 3R, 12).
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.
- D. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

### 3.2 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
  - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
  - 2. Outdoor Locations: NEMA 250, Type 3R.

### 3.3 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install fuses in fusible devices.
- F. Comply with NFPA 70 and NECA 1.

### 3.4 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### 3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections for Switches:
  1. Visual and Mechanical Inspection:
    - a. Inspect physical and mechanical condition.
    - b. Inspect anchorage, alignment, grounding, and clearances.
    - c. Verify that the unit is clean.
    - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
    - e. Verify that fuse sizes and types match the Specifications and Drawings.
    - f. Verify that each fuse has adequate mechanical support and contact integrity.
    - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
      - 1) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
        - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
    - h. Verify correct phase barrier installation.
    - i. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
- C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

### 3.6 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 26 2816

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Manual motor controllers.
  - 2. Combination full-voltage magnetic motor controllers.
  - 3. Enclosures.
  - 4. Accessories.
  - 5. Identification.

1.3 DEFINITIONS

- A. CPT: Control power transformer.
- B. MCCB: Molded-case circuit breaker.
- C. MCP: Motor circuit protector.
- D. NC: Normally closed.
- E. OCPD: Overcurrent protective device.
- F. SCCR: Short-circuit current rating.
- G. SCPD: Short-circuit protective device.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For each type of magnetic controller.

1. Include plans, elevations, sections, and mounting details.
2. Indicate dimensions, weights, required clearances, and location and size of each field connection.
3. Wire Termination Diagrams and Schedules: Include diagrams for signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.
4. Include features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

C. Product Schedule: List the following for each enclosed controller:

1. Each installed magnetic controller type.
2. NRTL listing.
3. Factory-installed accessories.
4. Nameplate legends.
5. SCCR of integrated unit.
6. For each combination magnetic controller include features, characteristics, ratings, and factory setting of the SCPD and OCPD.
  - a. Listing document proving Type 2 coordination.
7. For each series-rated combination state the listed integrated short-circuit current (withstand) rating of SCPD and OCPDs by an NRTL acceptable to authorities having jurisdiction.

## 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For magnetic controllers to include in operation and maintenance manuals.

1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:
  - a. Routine maintenance requirements for magnetic controllers and installed components.
  - b. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
  - c. Manufacturer's written instructions for setting field-adjustable overload relays.
  - d. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
  - e. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

## 1.6 QUALITY ASSURANCE

### A. Source Limitations:

1. Obtain enclosed controllers from the same manufacturer as:
  - a. Fusible and non-fusible switches.
  - b. Molded case circuit breakers.
  - c. Switchboards.
  - d. Distribution panelboards.
  - e. Branch circuit panelboards.
  - f. Motor control centers.
  - g. Enclosed busway.
  - h. Low voltage transformers.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

## 1.8 FIELD CONDITIONS

- A. Ambient Environment Ratings: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  1. Ambient Temperature: Not less than 23 deg F and not exceeding 104 deg F.
  2. Altitude: Not exceeding 6600 feet for electromagnetic and manual devices.
  3. The effect of solar radiation is not significant.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. UL Compliance: Fabricate and label magnetic motor controllers to comply with UL 508 and UL 60947-4-1.
- C. NEMA Compliance: Fabricate motor controllers to comply with ICS 2.

## 2.2 MANUAL MOTOR CONTROLLERS

- A. Motor-Starting Switches (MSS): "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton.
    - b. General Electric Company.
    - c. Siemens Industry, Inc.
    - d. Square D; by Schneider Electric.
  - 2. Standard: Comply with NEMA ICS 2, general purpose, Class A.
  - 3. Configuration: Nonreversing.
  - 4. Surface mounting.
  - 5. Red pilot light.
- B. Fractional Horsepower Manual Controllers (FHPMC): "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton.
    - b. General Electric Company.
    - c. Siemens Industry, Inc.
    - d. Square D; by Schneider Electric.
  - 2. Configuration: Nonreversing.
  - 3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; melting alloy type.
  - 4. Pilot Light: Red.

## 2.3 ENCLOSURES

- A. Comply with NEMA 250, type designations as indicated on Drawings, complying with environmental conditions at installed location.
  - 1. Dry and Clean Indoor Locations: Type 1.
  - 2. Outdoor Locations: Type 3R.
- B. The construction of the enclosures shall comply with NEMA ICS 6.
- C. Controllers in hazardous (classified) locations shall comply with UL 1203 and shall be NEMA 250, Type 7C.

## 2.4 ACCESSORIES

- A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
  - 1. Push Buttons, Pilot Lights, and Selector Switches: Standard-duty, except as needed to match enclosure type. Heavy-duty or oil-tight where indicated in the controller schedule.
    - a. Push Buttons: As indicated in the controller schedule.
    - b. Pilot Lights: As indicated in the controller schedule.

## 2.5 IDENTIFICATION

- A. Controller Nameplates: Laminated acrylic plastic signs, as described in Section 26 0553 "Identification for Electrical Systems," for each compartment, mounted with corrosion-resistant screws.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and space conditions for compliance with requirements for motor controllers, their relationship with the motors, and other conditions affecting performance of the Work.

### 3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Wall-Mounted Controllers: Install magnetic controllers on walls with tops at uniform height indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 26 0529 "Hangers and Supports for Electrical Systems" unless otherwise indicated.
- C. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.
- D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- E. Setting of Overload Relays: Select and set overloads on the basis of full-load current rating as shown on motor nameplate. Adjust setting value for special motors as required by NFPA 70 for motors that are high-torque, high-efficiency, and so on.



### 3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

### 3.4 APPLICATIONS

- A. Provide separately mounted motor controllers as scheduled and shown on the drawings.
- B. Provide separate hand-off auto selector switch with maintained contacts in separate enclosure adjacent to manual starters where shown on the drawings or noted in the starter schedule.
- C. Provide combination magnetic starters for all multiple phase operated equipment, as indicated in the starter schedule. All starters shall be complete with pilot lights in cover, externally operated fused disconnect switch, fuses, and three (3) proper sized overload heaters as required. Furnish additional accessories, such as auxiliary contacts, on-off selector switches, hand-off auto selector switches and push button with the starter as indicated in the schedule. All push-button and hand-off auto selector switches shall have maintained contacts.
- D. Provide all magnetic and manual starters with properly sized overload elements.
- E. Furnish controllers with additional accessories, such as auxiliary contacts, on-off push buttons and hand-off auto selector switches with the starter as indicated in the schedule.
- F. All magnetic starters shall be provided with control coils for 120 volt control voltage. All 208 volt starters shall have a neutral in the circuit and control voltage shall be phase to neutral 120 volts. Control transformers shall be furnished for 480 volt starters. Provide in-line fuse in secondary circuit of control transformer.
- G. The schedule of starters as shown on the drawings shall indicate motor horse power, phase, voltage, starter size, starter type, auxiliary contacts, types of accessories; such as push buttons or hand-off-automatic switches.

### 3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Comply with the provisions of NFPA 70B, "Testing and Test Methods" Chapter.
  - 2. Visual and Mechanical Inspection:
    - a. Compare equipment nameplate data with drawings and specifications.
    - b. Inspect physical and mechanical condition.
    - c. Inspect anchorage, alignment, and grounding.
    - d. Verify the unit is clean.
    - e. Inspect contactors:

- 1) Verify mechanical operation.
  - 2) Verify contact gap, wipe, alignment, and pressure are according to manufacturer's published data.
- f. Motor-Running Protection:
- 1) Verify overload element rating is correct for its application.
  - 2) If motor-running protection is provided by fuses, verify correct fuse rating.
- g. Inspect bolted electrical connections for high resistance using one of the two following methods:
- 1) Use a low-resistance ohmmeter. Compare bolted connection resistance values with values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
  - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
- h. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
3. Infrared Inspection: Perform the survey during periods of maximum possible loading. Remove all necessary covers prior to the inspection.
- a. Comply with the recommendations of NFPA 70B, "Testing and Test Methods" Chapter, "Infrared Inspection" Article.
  - b. After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared inspection of the electrical power connections of each motor controller.
  - c. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each motor controller 11 months after date of Substantial Completion.
  - d. Report of Infrared Inspection: Prepare a certified report that identifies the testing technician and equipment used, and lists the following results:
    - 1) Description of equipment to be tested.
    - 2) Discrepancies.
    - 3) Temperature difference between the area of concern and the reference area.
    - 4) Probable cause of temperature difference.
    - 5) Areas inspected. Identify inaccessible and unobservable areas and equipment.
    - 6) Load conditions at time of inspection.
    - 7) Photographs and thermograms of the deficient area.
    - 8) Recommended action.

- e. Equipment: Inspect distribution systems with imaging equipment capable of detecting a minimum temperature difference of 1°C at 30°C. The equipment shall detect emitted radiation and convert detected radiation to a visual signal.
- f. Act on inspection results and recommended action, and considering the recommendations of NETA ATS, Table 100.18. Correct possible and probable deficiencies as soon as Owner's operations permit. Retest until deficiencies are corrected.

C. Motor controller will be considered defective if it does not pass tests and inspections.

END OF SECTION 26 2913.03

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and Bidding and Contract Provisions, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Metal conduits and fittings.
  - 2. Surface raceways.
  - 3. Boxes, enclosures, and cabinets.
- B. Coordinate pathway installation with Temperature Control Subcontractor.

1.3 ACTION SUBMITTALS

- A. Product Data: For surface pathways, wireways and fittings.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. General Requirements for Metal Conduits and Fittings:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. EMT: Comply with ANSI C80.3 and UL 797.
- C. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

2.2 METAL WIREWAYS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

## 2.3 SURFACE PATHWAYS

- A. General Requirements for Surface Pathways:
  1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Pathways (Wiremold): Steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

## 2.4 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets.
- B. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- D. Device Box Dimensions: as required for the application.
- E. Cabinets shall be provided by the Control Subcontractor.

## PART 3 - EXECUTION

### 3.1 PATHWAY APPLICATION

- A. Indoors: Apply pathway products as specified below unless otherwise indicated:
  1. Exposed, in finished areas: Wiremold.
  2. Exposed, in unfinished areas (store rooms): EMT.
  3. Exposed and Subject to Severe Physical Damage: EMT. Pathway locations include the following:
    - a. Mechanical rooms.
  4. Concealed in Ceilings and Interior Walls and Partitions: Pathway not required.
  5. Horizontal Pathways for Communications Cable in Spaces Used for Environmental Air: Plenum-type, communications-cable in hog rings.
  6. Horizontal Pathways for Network Cable in Non-Plenum Ceiling Cavities: Cable with "hog rings".

- B. Minimum Pathway Size: 3/4-inch trade size.
- C. Pathway Fittings: Compatible with pathways and suitable for use and location.
  - 1. EMT: Use compression, steel fittings.

### 3.2 INSTALLATION

- A. Keep pathways at least 6 inches away from parallel runs of flues or hot-water pipes. Install horizontal pathway runs above water piping.
- B. Complete pathway installation before starting conductor installation.
- C. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for cables.
- D. Support conduit within 12 inches of enclosures to which attached.
- E. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- F. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- G. Cut conduit perpendicular to the length.
- H. Surface Pathways:
  - 1. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 36 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

### 3.3 EXISTING DDC CABLING

- A. Existing cabling may or may not be managed in terms of being neatly managed in ceiling cavities. This contract will not require that cabling to be cleaned up.
- B. All new cabling, however, must be neatly supported and managed. It is recommended that new cabling be a different color to avoid confusion between existing unmanaged cabling and new managed cabling.

END OF SECTION 27 0528

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and Bidding and Contract Provisions, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Network cabling to all DDC controls and controls and controllers and to building Ethernet.
  - 2. Cable connecting hardware, patch panels, and cross-connects.
  - 3. Cabling system identification products.
  - 4. Cable management system.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. LAN: Local area network.
- C. RCDD: Registered Communications Distribution Designer.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of cabling with Alpha Controls.

1.5 ACTION SUBMITTALS

- A. Shop Drawings:
  - 1. Cabling administration drawings and printouts.
  - 2. Wiring diagrams to show typical wiring schematics.

1.6 CLOSEOUT SUBMITTALS

- A. Software and Firmware Operational Documentation:

1. Device address list.
2. Printout of software application and graphic screens.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings and field testing program development by an RCDD employed by the Temperature Control Subcontractor.
  2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.

## PART 2 - PRODUCTS

### 2.1 CABLING

- A. Control Subcontractor shall consult with Owner's IT Administrator and ensure cable used will be compatible with Owner's network.
- B. Control Subcontractor shall consult with Owner's IT Administrator on method used to interface with Owner's network and facilitate remote access to control system.
- C. All cabling shall be plenum rated.

### 2.2 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.
1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
  2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
  3. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. The maximum allowable horizontal cable length will be determined by the Control Subcontractor.



## 2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1 when tested according to test procedures of this standard.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 50 or less.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Grounding: Comply with J-STD-607-A.

## 2.4 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

## 2.5 CABLE MANAGEMENT SYSTEM

- A. Description: Computer-based cable management system, with integrated database and graphic capabilities.
- B. Document physical characteristics by recording the network, TIA/EIA details, and connections between equipment and cable.
- C. Information shall be presented in schematic plans.
  - 1. AutoCAD drawing software shall be used as drawing and schematic plans software.
- D. System shall interface with the following testing and recording devices:
  - 1. Direct upload tests from circuit testing instrument into the personal computer.
  - 2. Direct download circuit labeling into labeling printer.

## 2.6 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing service to evaluate cables.

## PART 3 - EXECUTION

### 3.1 WIRING METHODS

- A. Install cables in pathways except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal pathways and cables except in unfinished spaces.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
  - 2. Comply with requirements in Section 270528 "Pathways for Communications Systems."
- B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

### 3.2 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Comply with TIA/EIA-568-B.1.
  - 2. Terminate conductors; no cable shall contain unterminated elements.
  - 3. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
- C. Open-Cable Installation:
  - 1. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- D. Separation from EMI Sources:
  - 1. Comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
  - 2. Separation between open communications cables in raceways and unshielded power conductors and electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
  - 3. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.

4. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

### 3.3 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."

### 3.4 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

END OF SECTION 27 1500



INDEX OF DRAWINGS	
C-100	COVER SHEET
M-100	BROOKENS POD 100 HVAC FLOOR PLAN
M-101	BROOKENS POD 200 HVAC FLOOR PLAN
M-102	BROOKENS POD 300 HVAC FLOOR PLAN
M-103	BROOKENS POD 400 HVAC FLOOR PLAN
M-104	JUVENILE DETENTION CENTER HVAC FLOOR PLAN
M-105	CHAMPAIGN COUNTY COURTHOUSE HVAC FLOOR PLAN
M-106	METCAD HVAC FLOOR PLAN
M-200	SCHEDULES - HVAC



 SATELLITE IMAGE  
SCALE: NO SCALE

FILE: H:\GHR Projects\7321 - Champaign County Administrative Services - Brookens - Hail Damage\HVAC\01 - Worksheets\7321 - C-100.dwg  
PRINTED: 04/23/2021

DATE	NO.	DESCRIPTION



**ENGINEERS AND ASSOCIATES, INC.**  
Mechanical & Electrical Consulting Engineers  
1615 South Neil Street, Champaign, Illinois 61820  
217-356-0536 Business - 217-356-1092 Fax

**COVER SHEET**  
**HAIL DAMAGED HVAC REPLACEMENT**  
CHAMPAIGN COUNTY  
1776 E WASHINGTON STREET, URBANA IL 61802

SEAL

DRAWN: JMD	APPROVED: RCVN
DATE: APRIL 23, 2021	
PROJECT: 95% CD	
GHR # 7321	

SHEET: **C-100**  
188



FILE: H:\GHR Projects\7321 - Champaign County Administrative Services - Brookens - Brookens - Hail Damage\HVAC\01 - Worksheets\7321 - M-100.dwg  
 PRINTED: 04/23/2021

③① RTU-5

③① RTU-1

③① RTU-2



KEYED NOTES —(FOR THIS PLAN ONLY ◻ SYMBOL)

- ① REMOVE EXISTING RTU. DISCONNECT RA AND SA DUCTWORK. DISCONNECT GAS, CONTROLS, AND POWER. INSTALL NEW RTU ON ROOF CURB ADAPTER. ADAPTER TO BE SIZED TO MOUNT NEW RTU ON EXISTING CURB. CONTRACTOR TO VERIFY ADAPTER MEASUREMENTS. CONNECT NEW RTU TO EXISTING GAS AND POWER. CONNECT EXISTING CONTROLS SYSTEM. INSTALL HAIL GUARD.
- ② RTU-8 TO REMAIN. INSTALL HAIL GUARD.
- ③ MODIFY SA AND RA DUCTWORK AS NEEDED TO CONNECT TO NEW UNIT.
- ④ CONNECT NEW PIPING TO EXISTING PIPING.

RTU-7 ①③

RTU-6 ①③

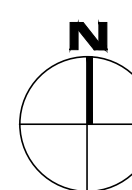
RTU-4 ①③

RTU-3 ①③

RTU-8 ②

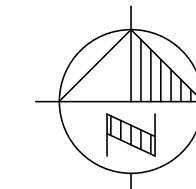
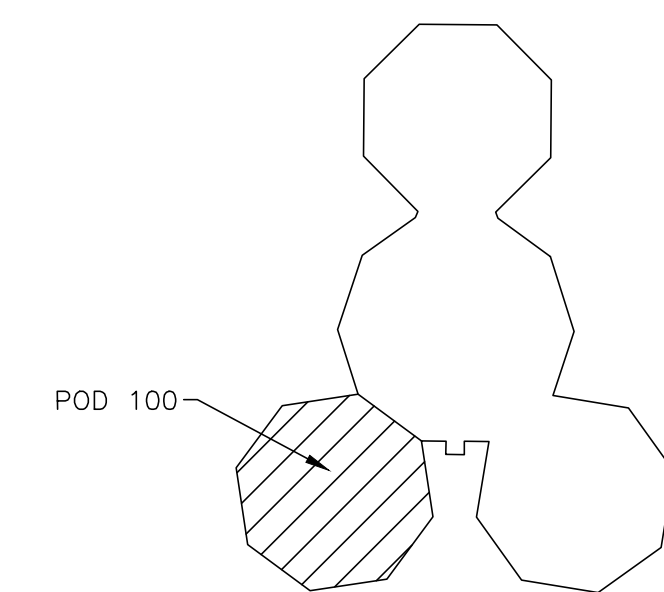
RTU-9 ①③④

RTU-10 ①③④



BROOKENS POD 100 HVAC FLOOR PLAN

NO SCALE



KEY PLAN — POD 100

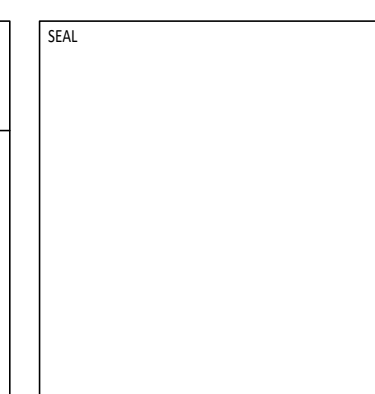
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DATE	NO.	DESCRIPTION

**GHR ENGINEERS AND ASSOCIATES, INC.**  
 Mechanical & Electrical Consulting Engineers  
 1615 South Neil Street, Champaign, Illinois 61820  
 217-356-0536 Business - 217-356-1092 Fax

**BROOKENS POD 100 HVAC FLOOR PLAN**  
**HAIL DAMAGED HVAC REPLACEMENT**

CHAMPAIGN COUNTY  
 1776 E WASHINGTON STREET, URBANA IL 61802



DRAWN: JMD	APPROVED: RCVN
DATE: APRIL 23, 2021	
PROJECT: 95% CD	
GHR # 7321	

SHEET:	<b>M-100</b>
	189



FILE: H:\GHR Projects\7321 - Champaign County Administrative Services - Brookens - Brookens - Hail Damage\HVAC\01 - Worksheets\7321 - M-101.dwg  
 PRINTED: 04/23/2021



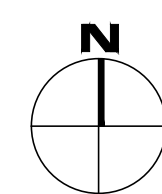
KEYED NOTES —(FOR THIS PLAN ONLY) (CIRCLE) SYMBOL

- ① REMOVE EXISTING CONDENSING UNIT ON ROOF. DISCONNECT POWER AND CONTROLS. REMOVE ASSOCIATED EVAPORATOR COIL. INSTALL NEW CONDENSING UNIT ON ROOF. CONNECT NEW UNIT TO EXISTING POWER AND CONTROLS. INSTALL NEW EVAPORATOR COIL. ROUTE REFRIGERANT PIPING FROM CONDENSING UNIT TO EVAPORATOR COIL. INSTALL HAIL GUARD.
- ② EXISTING CH-1&2 TO REMAIN. COMB OUT COILS TO REPAIR BENT FINS. INSTALL HAIL GUARD.
- ③ MODIFY SA AND RA DUCTWORK AS NEEDED TO CONNECT TO NEW UNIT.
- ④ CONNECT NEW PIPING TO EXISTING PIPING.

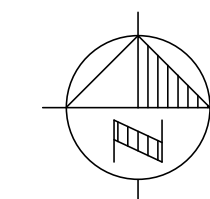
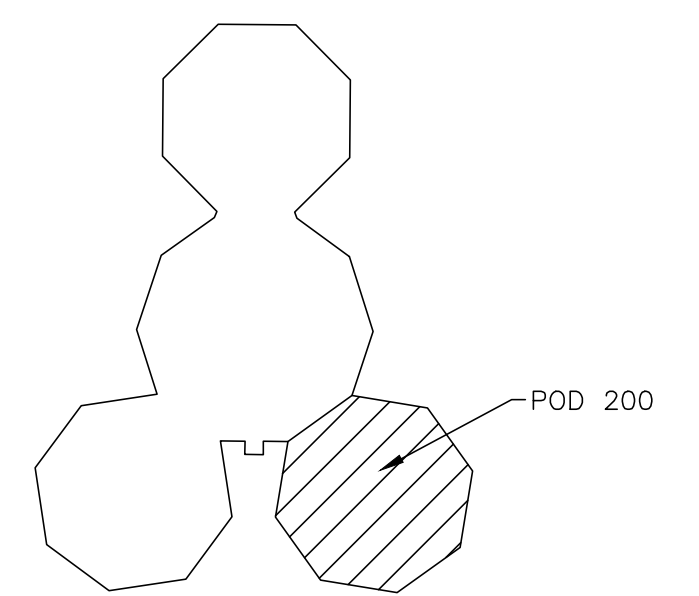
CH-2 (CIRCLE) 2

CH-1 (CIRCLE) 2

YORK MENTAL HEALTH UNIT (CIRCLE) 1 (CIRCLE) 3 (CIRCLE) 4



BROOKENS POD 200 HVAC FLOOR PLAN  
 NO SCALE



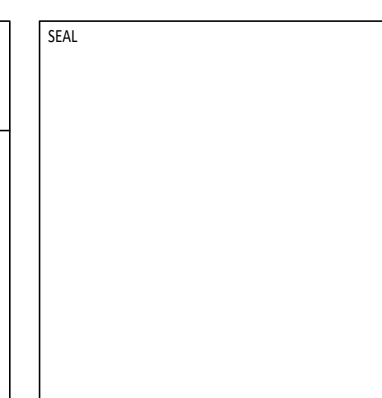
KEY PLAN — POD 200  
 SCALE: NO SCALE

DATE	NO.	DESCRIPTION

**GHR ENGINEERS AND ASSOCIATES, INC.**  
 Mechanical & Electrical Consulting Engineers  
 1615 South Neil Street, Champaign, Illinois 61820  
 217-356-0536 Business - 217-356-1092 Fax

**BROOKENS POD 200 HVAC FLOOR PLAN**  
**HAIL DAMAGED HVAC REPLACEMENT**

CHAMPAIGN COUNTY  
 1776 E WASHINGTON STREET, URBANA IL 61802

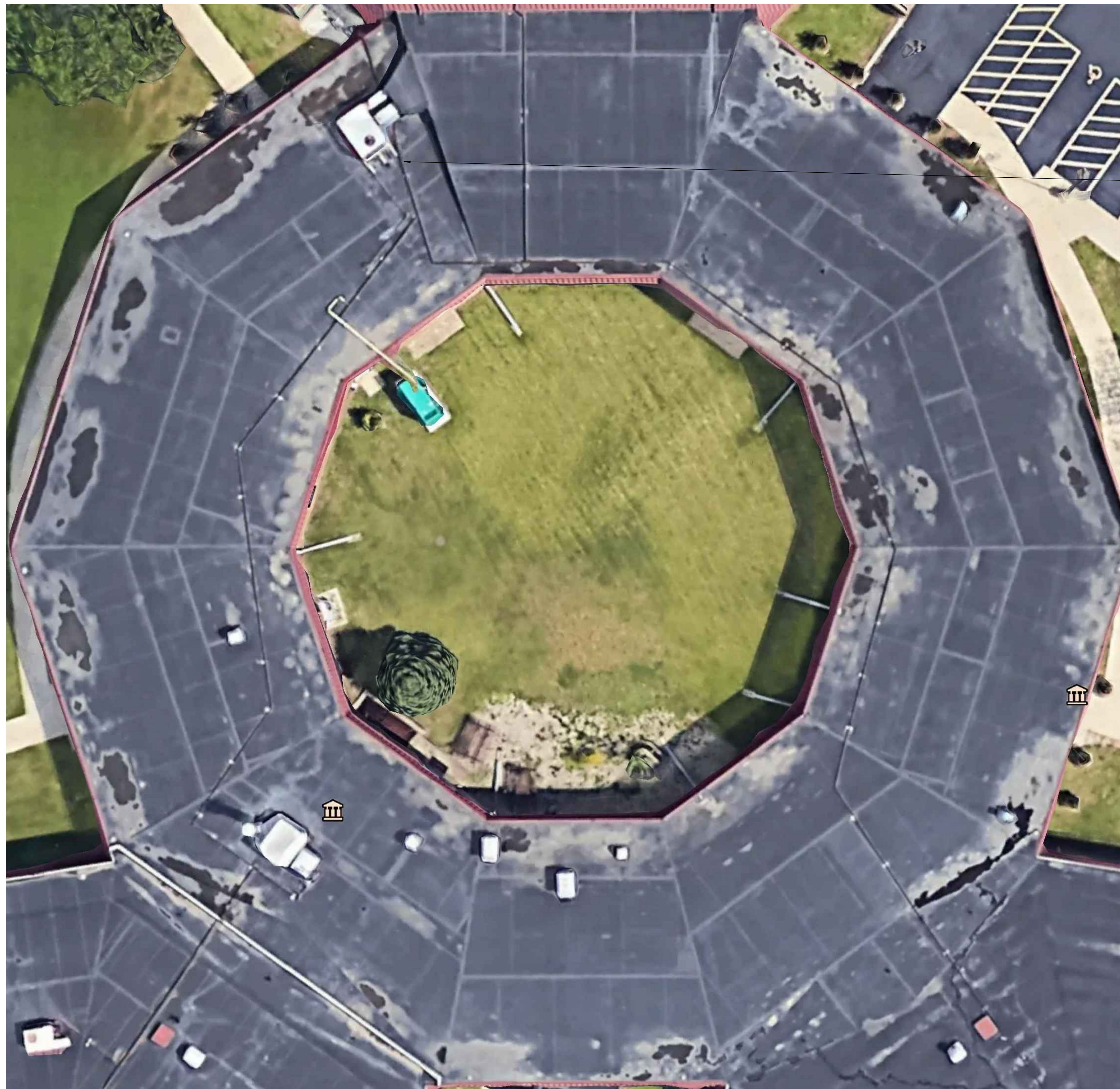


DRAWN: JMD	APPROVED: RCVN
DATE: APRIL 23, 2021	95% CD
PROJECT: GHR # 7321	

SHEET:  
**M-101**  
 190

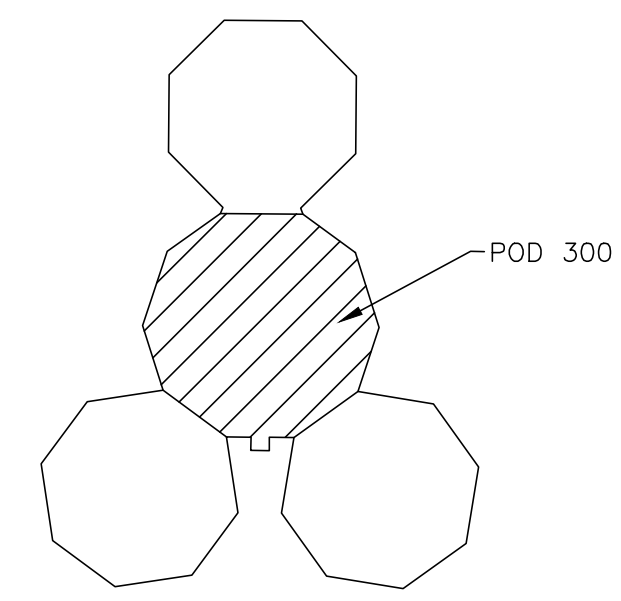


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 PRINTED: 04/23/2021



- KEYED NOTES —(FOR THIS PLAN ONLY) (SYMBOL)
- ① REMOVE EXISTING RTU. DISCONNECT RA AND SA DUCTWORK. DISCONNECT GAS, CONTROLS, AND POWER. INSTALL NEW RTU ON ROOF CURB ADAPTER. ADAPTER TO BE SIZED TO MOUNT NEW RTU ON EXISTING CURB. CONTRACTOR TO VERIFY ADAPTER MEASUREMENTS. CONNECT NEW RTU TO EXISTING GAS AND POWER. CONNECT EXISTING CONTROLS SYSTEM. INSTALL HAIL GUARD.
  - ② MODIFY SA AND RA DUCTWORK AS NEEDED TO CONNECT TO NEW UNIT.

LYLE SHIELDS UNIT ①②



KEY PLAN — POD 300  
 SCALE: NO SCALE

 BROOKENS POD 300 HVAC FLOOR PLAN  
 NO SCALE

DATE	NO.	DESCRIPTION

**GHR ENGINEERS AND ASSOCIATES, INC.**  
 Mechanical & Electrical Consulting Engineers  
 1615 South Neil Street, Champaign, Illinois 61820  
 217-356-0536 Business - 217-356-1092 Fax

**BROOKENS POD 300 HVAC FLOOR PLAN**  
**HAIL DAMAGED HVAC REPLACEMENT**  
 CHAMPAIGN COUNTY  
 1776 E WASHINGTON STREET, URBANA IL 61802

SEAL

DRAWN: JMD APPROVED: RCVN  
 DATE: APRIL 23, 2021  
 PROJECT: 95% CD  
 GHR # 7321

SHEET:  
**M-102**  
 191



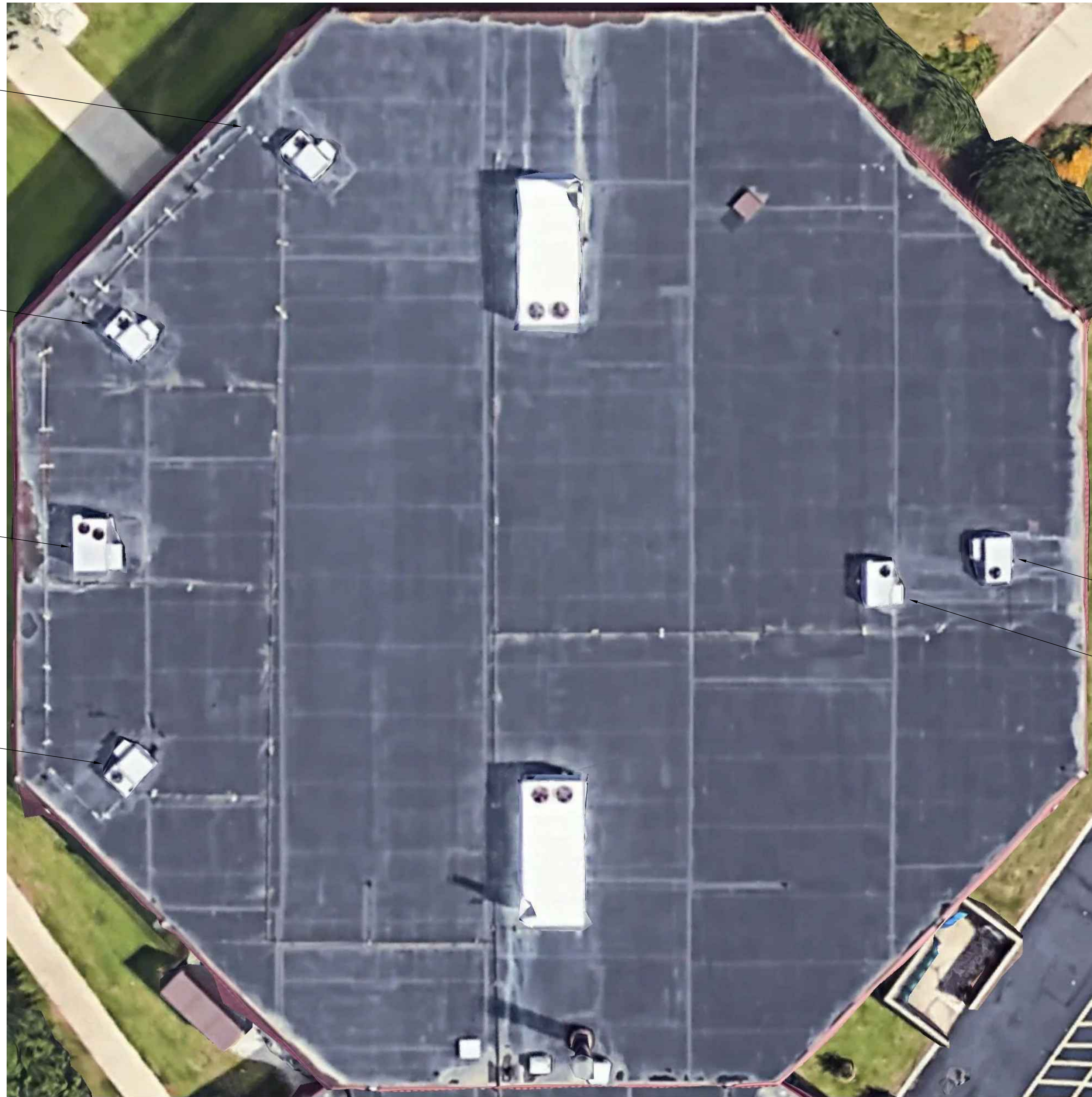
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 PRINTED: 04/23/2021

RTU-6

RTU-5

RTU-4

RTU-3

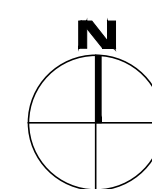


RTU-1

RTU-2

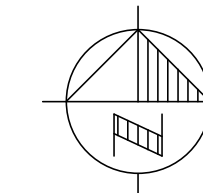
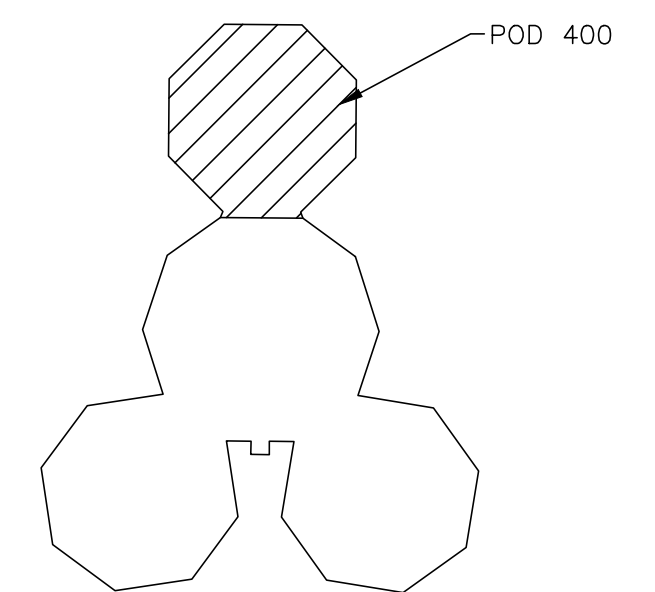
**KEYED NOTES** —(FOR THIS PLAN ONLY SYMBOL)

- ① REMOVE EXISTING RTU. DISCONNECT RA AND SA DUCTWORK. DISCONNECT GAS, CONTROLS, AND POWER. INSTALL NEW RTU ON ROOF CURB ADAPTER. ADAPTER TO BE SIZED TO MOUNT NEW RTU ON EXISTING CURB. CONTRACTOR TO VERIFY ADAPTER MEASUREMENTS. CONNECT NEW RTU TO EXISTING GAS AND POWER. CONNECT EXISTING CONTROLS SYSTEM. INSTALL HAIL GUARD.
- ② MODIFY SA AND RA DUCTWORK AS NEEDED TO CONNECT TO NEW UNIT.



**BROOKENS POD 400 HVAC FLOOR PLAN**

NO SCALE



**KEY PLAN - POD 400**

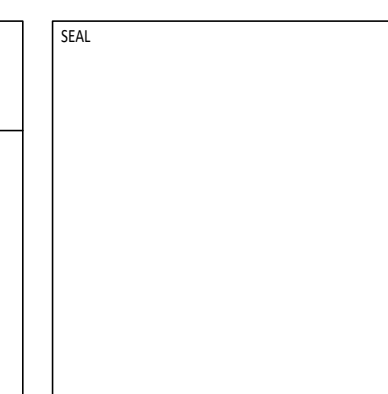
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DATE	NO.	DESCRIPTION

**GHR ENGINEERS AND ASSOCIATES, INC.**  
 Mechanical & Electrical Consulting Engineers  
 1615 South Neil Street, Champaign, Illinois 61820  
 217-356-0536 Business - 217-356-1092 Fax

**BROOKENS POD 400 HVAC FLOOR PLAN**  
**HAIL DAMAGED HVAC REPLACEMENT**

CHAMPAIGN COUNTY  
 1776 E WASHINGTON STREET, URBANA IL 61802



DRAWN: JMD	APPROVED: RCVN
DATE: APRIL 23, 2021	
PROJECT: 95% CD	
	GHR # 7321

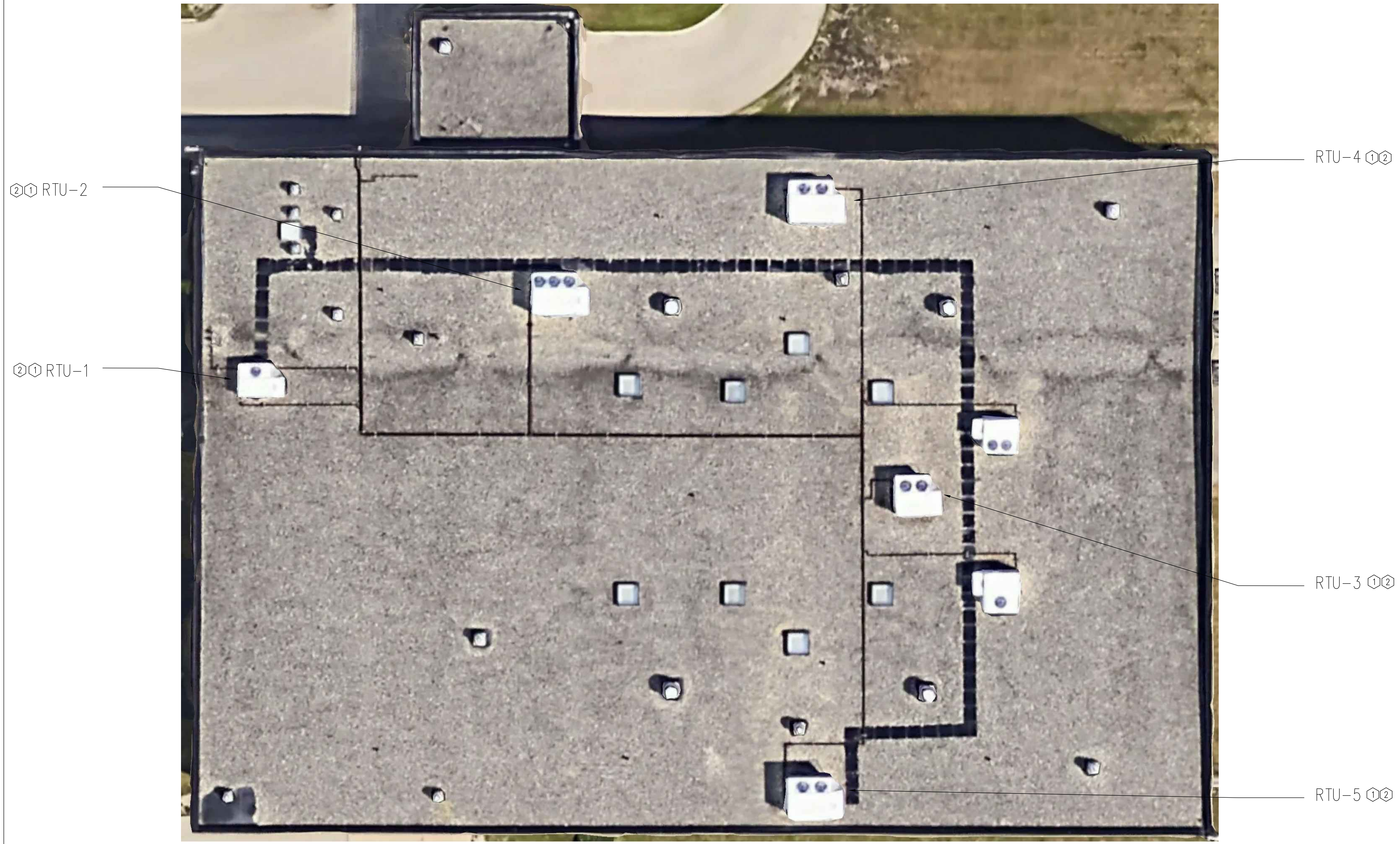
SHEET: **M-103**



FILE: H:\GHR Projects\7321 - Champaign County Administrative Services - Brookens - Hail Damage\HVAC\01 - Worksheets\7321 - M-104.dwg  
 PRINTED: 04/23/2021

KEYED NOTES --(FOR THIS PLAN ONLY) (SYMBOL)

- ① REMOVE EXISTING RTU. DISCONNECT RA AND SA DUCTWORK. DISCONNECT GAS, CONTROLS, AND POWER. INSTALL NEW RTU ON ROOF CURB ADAPTER. ADAPTER TO BE SIZED TO MOUNT NEW RTU ON EXISTING CURB. CONTRACTOR TO VERIFY ADAPTER MEASUREMENTS. CONNECT NEW RTU TO EXISTING GAS AND POWER. CONNECT EXISTING CONTROLS SYSTEM. INSTALL HAIL GUARD.
- ② MODIFY SA AND RA DUCTWORK AS NEEDED TO CONNECT TO NEW UNIT.



**N**  
 JUVENILE DETENTION CENTER HVAC FLOOR PLAN  
 NO SCALE

DATE	NO.	DESCRIPTION

**GHR ENGINEERS AND ASSOCIATES, INC.**  
 Mechanical & Electrical Consulting Engineers  
 1615 South Neil Street, Champaign, Illinois 61820  
 217-356-0536 Business - 217-356-1092 Fax

**JUVENILE DETENTION CENTER HVAC FLOOR PLAN**  
**HAIL DAMAGED HVAC REPLACEMENT**  
 CHAMPAIGN COUNTY  
 1776 E WASHINGTON STREET, URBANA IL 61802

SEAL

DRAWN: JMD	APPROVED: RCVN
DATE: APRIL 23, 2021	
PROJECT: 95% CD	
GHR # 7321	

SHEET: **M-104**  
 193







FILE: H:\GHR Projects\7321 - Champaign County Administrative Services - Brookens - Hail Damage\HVAC\01 - Worksheets\7321 - M-106.dwg  
 PRINTED: 04/23/2021

KEYED NOTES —(FOR THIS PLAN ONLY) (SYMBOL)

- ① REPLACE EXCHANGER COIL FOR SPLIT SYSTEM. INSTALL NEW PROPELLER FANS. INSTALL HAIL GUARDS.
- ② REPLACE COIL IN ACCU. INSTALL NEW FANS. INSTALL HAIL GUARD.
- ③ MODIFY SA AND RA DUCTWRK AS NEEDED TO CONNECT TO NEW UNIT.



②③ ACCU-5  
 ①③ ACCU-6

**N**  
 METCAD HVAC FLOOR PLAN  
 NO SCALE

DATE	NO.	DESCRIPTION

**GHR ENGINEERS AND ASSOCIATES, INC.**  
 Mechanical & Electrical Consulting Engineers  
 1615 South Neil Street, Champaign, Illinois 61820  
 217-356-0536 Business - 217-356-1092 Fax

**METCAD HVAC FLOOR PLAN**  
**HAIL DAMAGED HVAC REPLACEMENT**  
 CHAMPAIGN COUNTY  
 1776 E WASHINGTON STREET, URBANA IL 61802

SEAL	DRAWN: JMD	APPROVED: RVCN	SHEET: <b>M-106</b> 195
	DATE: APRIL 23, 2021	95% CD	
	PROJECT: GHR # 7321		

FILE: H:\GHR Projects\7321 - Champaign County Administrative Services - Brookens - Hail Damage\HVAC\01 - Worksheets\7321 - M-200.dwg  
 PRINTED: 04/23/2021

SCHEDULE OF GAS FIRED ROOF TOP UNITS																							
MARK	LOCATION	MANUFACTURER	MODEL	CFM	MIN OA CFM	E.S.P.	BLOWER			RPM	HEATING DATA INPUT/OUTPUT (MBH)	COOLING CAPACITY		LAT (db/wb)	MEDIUM (%)	EER	ELECTRICAL DATA				FILTER		Remarks
							H.P.	Volts / Phase				Total (MBH)	Sens. (MBH)				FLA	Volts / Phase	M.C.A.	M.O.P.	Quantity	Size	
RTU-1	POD 100	TRANE	YSD150C3RHC	5000		0.5	3.0			1100	250/200	148	120			11	8.2	230/3	61	80	40		
RTU-2	POD 100	TRANE	YSC120H3RLA	4000		0.5				1100	150/120	116.3	96.8			11.2	7.3	230/3	49	60	4	20x25x2	
RTU-3	POD 100	TRANE	YSC048G3RMB	1600		0.5				-	100/81	116.3	96.8			11.2	7.3	230/3	49	60	4	20x25x2	
RTU-4	POD 100	TRANE	YSC060G3RMB	2000		0.5				1750	100/81	60.1	49.4			14	8.2	230/3	29	40	2	20x30x2	
RTU-5	POD 100	LENNOX	KGB048	1560							95/76	42.9				11.6	3.6	420/3	12	15	4	16x20x2	
RTU-6	POD 100	LENNOX	KGB060	1760							95/76	53.8				12	3.6	420/3	15	20	4	20x20x2	
RTU-7	POD 100	LENNOX	KGB060	1760							95/76	53.8				12	3.6	420/3	15	20	4	20x20x2	
RTU-9	POD 100	LENNOX	KGB092	3000							117/144	93				12.5	4.8	420/3	22	25	4	20x25x2	
RTU-10	POD 100	LENNOX	KGB048	1560							95/76	42.9				11.6	3.6	420/3	12	15	4	16x20x2	
LS UNIT	POD 300	TRANE	YSC120H3EHA	4000		0.5	2.75	230/60		1377	95/76	116.26	96.80			11.2	3	230/3	49	60	4	20x25x2	
RTU-1	POD 400	CARRIER	48FCEA06F2M5	1500						2150	90/73	58.5				11	1.9	230/3	35		4	16x16x2	
RTU-2	POD 400	CARRIER	48FCEA06F2M5	1500						2150	90/73	58.5				11	1.9	230/3	35		2	16x25x2	
RTU-3	POD 400	CARRIER	48FCEA07F2M5	1800						2300	110/88	70.0				11	1.9	230/3	33		4	16x16x2	
RTU-4	POD 400	CARRIER	48TCED14F2M5	3600						1175	224/184	140.0				10.8	9.8	230/3	65		4	20x20x2	
RTU-5	POD 400	CARRIER	48FCEA07F2M5	1800						2300	110/88	70.0				11	1.9	230/3	33		4	16x16x2	
RTU-6	POD 400	CARRIER	48FCEA07F2M5	1800						2300	110/88	70.0				11	1.9	230/3	33		4	16x16x2	

NOTES  
 COOLING EAT: ??Fab / ??Fwb  
 COOLING AMBIENT AIR: ??F

7/17/07 10:14 AM \\data01\DATA\hvact\01 - HVAC Base Folder\HVAC Base Project Folder\02 - Excel\03 - Schedules - HVAC.kjt Gas RTU

SCHEDULE OF AIR COOLED CONDENSING UNITS													
MARK	MANUFACTURER	MODEL	LOCATION	CAPACITY (BTU)	VOLTS / PHASE	COMPRESSOR(S)			CONDENSER FAN(S)			SEER (EER)	REMARKS
						Number	RLA	K.W.	Number	H.P.	Phase		
YMH UNIT	YORK	YC090	POD 200	89.3	208/3	1	25	6.8	1	1/3	1	11.2	

NOTES

7/10/07 4:35 PM H:\hvact\01 - HVAC Base Folder\HVAC Base Project Folder\02 - Excel\03 - Schedules - HVAC.kjt Air Cooled Cond Units

SCHEDULE OF SPLIT SYSTEM COOLING UNITS													
MARK	MANUFACTURER	MODEL COND / EVAP	LOCATION	CONDENSER		EVAPORATOR		SENERBLE CAPACITY (MBH)	EVAPORATOR FAN ESP	CONDENSER FAN ESP	CONDENSER VOLTAGE	CONDENSER PHASE	REMARKS
				EAT	ABELOW	EAT	ABELOW						
ACCU-4	TRANE		ROOF					40			208V	3C	40

DATE	NO.	DESCRIPTION



**GHR ENGINEERS AND ASSOCIATES, INC.**  
 Mechanical & Electrical Consulting Engineers  
 1615 South Neil Street, Champaign, Illinois 61820  
 217-356-0536 Business - 217-356-1092 Fax

**SCHEDULES - HVAC**  
**HAIL DAMAGED HVAC REPLACEMENT**  
 CHAMPAIGN COUNTY  
 1776 E WASHINGTON STREET, URBANA IL 61802

SEAL

DRAWN: **JMD** APPROVED: **RCVN**  
 DATE: **APRIL 23, 2021**  
 PROJECT: **95% CD**  
**GHR # 7321**

SHEET: **M-200**  
 196



# **PROJECT MANUAL**

## **CHAMPAIGN COUNTY COURTHOUSE ROOF REPLACEMENT**

FOR

CHAMPAIGN COUNTY, ILLINOIS  
101 E. Main Street  
URBANA, ILLINOIS 61801

### **95% DESIGN REVIEW**

Architect's Project # 20156

ITB # 2021-002

April 30, 2021

**Bailey Edward Design, Inc.**  
1103 S. Mattis Avenue  
Champaign, Illinois 61821  
217.363.3375

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SPECIFIER(S): Architectural: Todd Higginbotham, Bailey Edward Design, Inc.  
217.363.3375 Email: [thigginbotham@baileyedward.com](mailto:thigginbotham@baileyedward.com)

DIVISION 0 – BIDDING AND CONTRACT REQUIREMENTS  
Section 00 11 16 – Invitation to Bid

**INVITATION TO BID:**

**CHAMPAIGN COUNTY COURTHOUSE ROOF REPLACEMENT**

Sealed bids for the Champaign County Courthouse Roof Replacement Project will be received by the Champaign County at the Brookens Administrative Center, 1776 East Washington Street, Urbana, IL 61802. Bids will be opened publicly.

Work generally includes but is not limited to the following:

- Remove existing asphalt shingle system and underlayment completely down to roof deck
- Remove existing flashing and copings where indicated on Drawings.
- Install roof underlayment, ice/water shield, and asphalt shingle system
- Install metal flashings and coping.
- Replace damaged copper copings and valley flashings.

Proposals must be submitted on the forms provided and shall contain no qualifications or interlineations. In submitting a bid, it is agreed that the bid may not be withdrawn for a period of thirty (30) days after Bid Date.

The Owner reserves the right to require from any bidder, prior to contract award, a detailed statement regarding the business and technical organization of the bidder that is available for the contemplated work, and a list of his proposed subcontractors. Information pertaining to financial resources may also be required.

A Bid Security in the form of a cashier's check, certified check, or acceptable bidder's surety bond, made payable to the Owner, in an amount that is not less than ten percent (10%) of the Bid proposal submitted, including all Alternates, shall accompany each Bid as a guarantee that: (1) the Bidder will not modify, withdraw or cancel the proposal for thirty (30) days after the bid date; and (2) the bidder, if awarded the contract, will promptly enter into a contract and execute such bonds and furnish such insurance certificates as may be required. Should the Bidder fail to honor these two (2) guarantees for any reason, the Owner shall total the damages and shall deduct the amount of such damages from the Bidder's Bid Security. Should the damages total less than the amount of the Bid Security, the difference shall be returned to the Bidder. However, all damages in excess of the Bid Security shall be borne by the Owner. Damages may include, but shall not be limited to, reasonable compensation for the Owner's additional time spent, additional Architect's fees, costs to the Owner for delays in completion of the Work based upon the Bidders proposed Contract Time and the Contract Time as Awarded including, but not limited to, interest expense and lost revenue, the difference between the Bidder's proposed Contract Sum and the Contract Sum as awarded and costs to re bid the Project should such action become necessary. Such bid securities will be returned to the unsuccessful bidders after execution of the Contract.

Sealed bids for the proposed work will be received up to the hour of **2:00 P.M.** Central Daylight Time on **Friday, June 4, 2021** at the Lyle Shields Meeting Room, Brookens Administrative Center, 1776 East Washington Street, Urbana, IL 61802.

A pre-bid conference will be held in the Lyle Shields Meeting Room, Brookens Administrative Center, 1776 East Washington Street, Urbana, IL 61802, on **Friday, May 14, 2021** at **2:00 P.M.** CDT.

A complete set of documents will be available from Dean's Superior Blueprint, 404 E. University Ave., Champaign, IL. 61820, [www.deansblueprint.com](http://www.deansblueprint.com), 217.359.3261.

Refundable Plan Deposit: \$75 for each set of bid documents. Two (2) sets maximum, Additional sets may be purchased without refund. For Electronic sets, contact Bailey Edward at 217.363.3375 or [icollett@baileyedward.com](mailto:icollett@baileyedward.com)

Plan deposits will be refunded in full upon the return of the Bid Documents, in good condition, within ten (10) days after the bid opening. The deposits of General Contractors, who do not submit a bonafide bid or do not return the Bid Documents within ten (10) days after the bid opening, will not be refunded.

Contractor and Subcontractors shall include in bids, the cost for the current prevailing wage (Illinois Prevailing Wage Act - 820 ILCS 130/0.01 et seq.). The Contractor shall ensure that any Subcontractors shall comply with the Illinois Prevailing Wage Act.

The Owner reserves the right to reject any or all bids, to waive any irregularities in the bidding, or to accept the bids that in their judgment will be for their best interest.

Once awarded the contract, the Contractor will furnish a satisfactory performance bond, execute the contract and proceed with the work. The Contractor shall indicate the amount of the performance bond on the bid form.

END OF SECTION 00 11 16



DIVISION 0 – BIDDING AND CONTRACT REQUIREMENTS

PART 1 - Section 00 21 13 – Instructions to Bidders

1.1 INSTRUCTIONS TO BIDDERS

- A. AIA Document A701, "Instructions to Bidders," is hereby incorporated into the Procurement and Contracting Requirements by reference.
  - 1. A copy of AIA Document A701-2018, "Instructions to Bidders," is bound in this Project Manual.
  
- B. AIA Document A201 "General Conditions" is hereby incorporated into the Procurement.
  - 1. A copy of AIA Document A201-2017 "General Conditions" is bound in this project manual.

END OF DOCUMENT 00 21 13



# AIA<sup>®</sup> Document A701<sup>™</sup> – 2018

## Instructions to Bidders

for the following Project:  
(Name, location, and detailed description)

Champaign County Courthouse Roof Replacement  
101 E. Main Street  
Urbana, IL 61801

**THE OWNER:**  
(Name, legal status, address, and other information)

Champaign County, IL  
1776 East Washington Street  
Urbana, IL 61802

**THE ARCHITECT:**  
(Name, legal status, address, and other information)

Bailey Edward Design, Inc.  
1103 S. Mattis Avenue  
Champaign, IL 61821  
Telephone Number: 217.363.3375

### TABLE OF ARTICLES

- 1 DEFINITIONS
- 2 BIDDER'S REPRESENTATIONS
- 3 BIDDING DOCUMENTS
- 4 BIDDING PROCEDURES
- 5 CONSIDERATION OF BIDS
- 6 POST-BID INFORMATION
- 7 PERFORMANCE BOND AND PAYMENT BOND
- 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

**ADDITIONS AND DELETIONS:**  
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

FEDERAL, STATE, AND LOCAL LAWS MAY IMPOSE REQUIREMENTS ON PUBLIC PROCUREMENT CONTRACTS. CONSULT LOCAL AUTHORITIES OR AN ATTORNEY TO VERIFY REQUIREMENTS APPLICABLE TO THIS PROCUREMENT BEFORE COMPLETING THIS FORM.

It is intended that AIA Document G612<sup>™</sup>–2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.

## ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation to bid, Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect, which, by additions, deletions, clarifications, or corrections, modify or interpret the Bidding Documents.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents, to which Work may be added or deleted by sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from, or that does not change, the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment, or labor for a portion of the Work.

## ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 By submitting a Bid, the Bidder represents that:

- .1 the Bidder has read and understands the Bidding Documents;
- .2 the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- .3 the Bid complies with the Bidding Documents;
- .4 the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;
- .5 the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and
- .6 the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

## ARTICLE 3 BIDDING DOCUMENTS

### § 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.

*(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)*

§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

§ 3.1.3 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the advertisement or invitation to bid, or in supplementary instructions to bidders.

§ 3.1.4 Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

### § 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids. *(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)*

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them.

### § 3.3 Substitutions

§ 3.3.1 The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

#### § 3.3.2 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

§ 3.3.2.2 Bidders shall submit substitution requests on a Substitution Request Form if one is provided in the Bidding Documents.

§ 3.3.2.3 If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

§ 3.3.3 The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.4 If the Architect approves a proposed substitution prior to receipt of Bids, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3.5 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

#### § 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

*(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)*

§ 3.4.2 Addenda will be available where Bidding Documents are on file.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids, except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Prior to submitting a Bid, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

### ARTICLE 4 BIDDING PROCEDURES

#### § 4.1 Preparation of Bids

§ 4.1.1 Bids shall be submitted on the forms included with or identified in the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed. Paper bid forms shall be executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

§ 4.1.4 Edits to entries made on paper bid forms must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter “No Change” or as required by the bid form.

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder’s refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall neither make additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached, certifying the agent’s authority to bind the Bidder.

§ 4.1.8 A Bidder shall incur all costs associated with the preparation of its Bid.

#### § 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:

*(Insert the form and amount of bid security.)*

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount

of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

**§ 4.2.3** If a surety bond is required as bid security, it shall be written on AIA Document A310™, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

**§ 4.2.4** The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning days after the opening of Bids, withdraw its Bid and request the return of its bid security.

### **§ 4.3 Submission of Bids**

**§ 4.3.1** A Bidder shall submit its Bid as indicated below:

*(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)*

**§ 4.3.2** Paper copies of the Bid, the bid security, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address, and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

**§ 4.3.3** Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

**§ 4.3.4** The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

**§ 4.3.5** A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

### **§ 4.4 Modification or Withdrawal of Bid**

**§ 4.4.1** Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

**§ 4.4.2** Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

**§ 4.4.3** After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows:

*(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)*



## ARTICLE 5 CONSIDERATION OF BIDS

### § 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

### § 5.2 Rejection of Bids

Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

### § 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

§ 5.3.2 Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

## ARTICLE 6 POST-BID INFORMATION

### § 6.1 Contractor's Qualification Statement

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

### § 6.2 Owner's Financial Capability

A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

### § 6.3 Submittals

§ 6.3.1 After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

- .1 a designation of the Work to be performed with the Bidder's own forces;
- .2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and
- .3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

## ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

### § 7.1 Bond Requirements

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.

*(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)*

### § 7.2 Time of Delivery and Form of Bonds

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to commence sooner in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix to the bond a certified and current copy of the power of attorney.

## ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

- .1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.  
*(Insert the complete AIA Document number, including year, and Document title.)*
- .2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.  
*(Insert the complete AIA Document number, including year, and Document title.)*
- .3 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.  
*(Insert the complete AIA Document number, including year, and Document title.)*
- .4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:  
*(Insert the date of the E203-2013.)*



.5 Drawings

Number	Title	Date
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.6 Specifications

Section	Title	Date	Pages
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.7 Addenda:

Number	Date	Pages
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.8 Other Exhibits:

*(Check all boxes that apply and include appropriate information identifying the exhibit where required.)*

AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:  
*(Insert the date of the E204-2017.)*

The Sustainability Plan:

Title	Date	Pages
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Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
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.9 Other documents listed below:

*(List here any additional documents that are intended to form part of the Proposed Contract Documents.)*

## General Conditions of the Contract for Construction

**for the following PROJECT:**

*(Name and location or address)*

Champaign County Courthouse Roof Replacement  
101 E. Main Street  
Urbana, IL 61801

**THE OWNER:**

*(Name, legal status and address)*

Champaign County, Illinois  
1776 East Washington Street  
Urbana, IL 61802

**THE ARCHITECT:**

*(Name, legal status and address)*

Bailey Edward Design, Inc,  
1103 S. Mattis Avenue  
Champaign, IL 61821

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This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

Init.

## 14 TERMINATION OR SUSPENSION OF THE CONTRACT

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## ARTICLE 1 GENERAL PROVISIONS

### § 1.1 Basic Definitions

#### § 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

#### § 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

#### § 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

#### § 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

#### § 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

#### § 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

#### § 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

#### § 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

### § 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent

consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

**§ 1.2.1.1** The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

**§ 1.2.2** Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

**§ 1.2.3** Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

### **§ 1.3 Capitalization**

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

### **§ 1.4 Interpretation**

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

### **§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service**

**§ 1.5.1** The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

**§ 1.5.2** The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

### **§ 1.6 Notice**

**§ 1.6.1** Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

**§ 1.6.2** Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

### **§ 1.7 Digital Data Use and Transmission**

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

## § 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

## ARTICLE 2 OWNER

### § 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

### § 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

### § 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements,



assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

**§ 2.3.2** The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

**§ 2.3.3** If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

**§ 2.3.4** The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

**§ 2.3.5** The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

**§ 2.3.6** Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

#### **§ 2.4 Owner's Right to Stop the Work**

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

#### **§ 2.5 Owner's Right to Carry Out the Work**

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

### **ARTICLE 3 CONTRACTOR**

#### **§ 3.1 General**

**§ 3.1.1** The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

**§ 3.1.2** The Contractor shall perform the Work in accordance with the Contract Documents.

**§ 3.1.3** The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

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### § 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

### § 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

### § 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

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**§ 3.4.2** Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

**§ 3.4.3** The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

### **§ 3.5 Warranty**

**§ 3.5.1** The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

**§ 3.5.2** All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

### **§ 3.6 Taxes**

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

### **§ 3.7 Permits, Fees, Notices and Compliance with Laws**

**§ 3.7.1** Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

**§ 3.7.2** The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

**§ 3.7.3** If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

### **§ 3.7.4 Concealed or Unknown Conditions**

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

### § 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

### § 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

### § 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the



Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

**§ 3.10.3** The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

### **§ 3.11 Documents and Samples at the Site**

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

### **§ 3.12 Shop Drawings, Product Data and Samples**

**§ 3.12.1** Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

**§ 3.12.2** Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

**§ 3.12.3** Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

**§ 3.12.4** Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

**§ 3.12.5** The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

**§ 3.12.6** By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

**§ 3.12.7** The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

**§ 3.12.8** The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

### § 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

### § 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

### § 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

### § 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

### § 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

### § 3.18 Indemnification

**§ 3.18.1** To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

**§ 3.18.2** In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

## ARTICLE 4 ARCHITECT

### § 4.1 General

**§ 4.1.1** The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

**§ 4.1.2** Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

### § 4.2 Administration of the Contract

**§ 4.2.1** The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

**§ 4.2.2** The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

**§ 4.2.3** On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the

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Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

#### § 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations



and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

**§ 4.2.13** The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

**§ 4.2.14** The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

## **ARTICLE 5 SUBCONTRACTORS**

### **§ 5.1 Definitions**

**§ 5.1.1** A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

**§ 5.1.2** A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

### **§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work**

**§ 5.2.1** Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

**§ 5.2.2** The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

**§ 5.2.3** If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

**§ 5.2.4** The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

### **§ 5.3 Subcontractual Relations**

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor,

prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Subcontractors.

#### **§ 5.4 Contingent Assignment of Subcontracts**

**§ 5.4.1** Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

**§ 5.4.2** Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

**§ 5.4.3** Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

### **ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS**

#### **§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts**

**§ 6.1.1** The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

**§ 6.1.2** When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

**§ 6.1.3** The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

**§ 6.1.4** Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

#### **§ 6.2 Mutual Responsibility**

**§ 6.2.1** The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

**§ 6.2.2** If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work,

promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

**§ 6.2.3** The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

**§ 6.2.4** The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

**§ 6.2.5** The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

### **§ 6.3 Owner's Right to Clean Up**

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

## **ARTICLE 7 CHANGES IN THE WORK**

### **§ 7.1 General**

**§ 7.1.1** Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

**§ 7.1.2** A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

**§ 7.1.3** Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

### **§ 7.2 Change Orders**

**§ 7.2.1** A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

### **§ 7.3 Construction Change Directives**

**§ 7.3.1** A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

**§ 7.3.2** A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

**§ 7.3.3** If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

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- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

#### § 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will



affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

## **ARTICLE 8 TIME**

### **§ 8.1 Definitions**

**§ 8.1.1** Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

**§ 8.1.2** The date of commencement of the Work is the date established in the Agreement.

**§ 8.1.3** The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

**§ 8.1.4** The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

### **§ 8.2 Progress and Completion**

**§ 8.2.1** Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

**§ 8.2.2** The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

**§ 8.2.3** The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

### **§ 8.3 Delays and Extensions of Time**

**§ 8.3.1** If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

**§ 8.3.2** Claims relating to time shall be made in accordance with applicable provisions of Article 15.

**§ 8.3.3** This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

## **ARTICLE 9 PAYMENTS AND COMPLETION**

### **§ 9.1 Contract Sum**

**§ 9.1.1** The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

**§ 9.1.2** If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

### **§ 9.2 Schedule of Values**

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and

unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

### § 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

### § 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

## § 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

## § 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

**§ 9.6.6** A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

**§ 9.6.7** Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

**§ 9.6.8** Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

### **§ 9.7 Failure of Payment**

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

### **§ 9.8 Substantial Completion**

**§ 9.8.1** Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

**§ 9.8.2** When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

**§ 9.8.3** Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

**§ 9.8.4** When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

**§ 9.8.5** The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.



## § 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

## § 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

## ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

### § 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

### § 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

### § 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

### § 10.3 Hazardous Materials and Substances

**§ 10.3.1** The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

**§ 10.3.2** Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

**§ 10.3.3** To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

**§ 10.3.4** The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

**§ 10.3.5** The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

**§ 10.3.6** If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

### § 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

## ARTICLE 11 INSURANCE AND BONDS

### § 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 **Notice of Cancellation or Expiration of Contractor's Required Insurance.** Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

### § 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 **Failure to Purchase Required Property Insurance.** If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 **Notice of Cancellation or Expiration of Owner's Required Property Insurance.** Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.



### § 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

### § 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

### § 11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

## ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

### § 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to

the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

## **§ 12.2 Correction of Work**

### **§ 12.2.1 Before Substantial Completion**

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

### **§ 12.2.2 After Substantial Completion**

**§ 12.2.2.1** In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

**§ 12.2.2.2** The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

**§ 12.2.2.3** The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

**§ 12.2.3** The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

**§ 12.2.4** The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

**§ 12.2.5** Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

## **§ 12.3 Acceptance of Nonconforming Work**

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

## **ARTICLE 13 MISCELLANEOUS PROVISIONS**

### **§ 13.1 Governing Law**

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

## § 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

## § 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

## § 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

## § 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

## ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

### § 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

### § 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or Suppliers;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance,



the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

#### **§ 14.3 Suspension by the Owner for Convenience**

**§ 14.3.1** The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

**§ 14.3.2** The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

#### **§ 14.4 Termination by the Owner for Convenience**

**§ 14.4.1** The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

**§ 14.4.2** Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

**§ 14.4.3** In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

### **ARTICLE 15 CLAIMS AND DISPUTES**

#### **§ 15.1 Claims**

##### **§ 15.1.1 Definition**

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

##### **§ 15.1.2 Time Limits on Claims**

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

##### **§ 15.1.3 Notice of Claims**

**§ 15.1.3.1** Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

**§ 15.1.3.2** Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

#### **§ 15.1.4 Continuing Contract Performance**

**§ 15.1.4.1** Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

**§ 15.1.4.2** The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

#### **§ 15.1.5 Claims for Additional Cost**

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

#### **§ 15.1.6 Claims for Additional Time**

**§ 15.1.6.1** If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

**§ 15.1.6.2** If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

#### **§ 15.1.7 Waiver of Claims for Consequential Damages**

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

#### **§ 15.2 Initial Decision**

**§ 15.2.1** Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

**§ 15.2.2** The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the

Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

**§ 15.2.3** In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

**§ 15.2.4** If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

**§ 15.2.5** The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

**§ 15.2.6** Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

**§ 15.2.6.1** Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

**§ 15.2.7** In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

**§ 15.2.8** If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

### **§ 15.3 Mediation**

**§ 15.3.1** Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

**§ 15.3.2** The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

**§ 15.3.3** Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

#### § 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

#### § 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.



DIVISION 0 – BIDDING AND CONTRACT REQUIREMENTS  
Section 00 22 13 – Supplementary Instructions to Bidders

1.1 INSTRUCTIONS TO BIDDERS

- A. Instructions to Bidders for Project consist of the following:
1. AIA Document A701 - 2018, "Instructions to Bidders" a copy of which is bound in this Project Manual.
  2. The following Supplementary Instructions to Bidders that modify and add to the requirements of the Instructions to Bidders.

1.2 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS, GENERAL

- A. The following supplements modify AIA Document A701, "Instructions to Bidders." Where a portion of the Instructions to Bidders is modified or deleted by these Supplementary Instructions to Bidders, unaltered portions of the Instructions to Bidders shall remain in effect.

1.3 ARTICLE 2 - BIDDER'S REPRESENTATIONS

- A. Add Section 2.1.7:
1. 2.1.7 - The Bidder has investigated all required fees, permits, and regulatory requirements of authorities having jurisdiction and has properly included in the submitted bid the cost of such fees, permits, and requirements not otherwise indicated as provided by Owner.
- B. Add Section 2.1.8:
1. 2.1.8 - The Bidder is a properly licensed Contractor according to the laws and regulations of the local and state jurisdictions and meets qualifications indicated in the Procurement and Contracting Documents.
- C. Add Section 2.1.9:
1. 2.1.9 - The Bidder has incorporated into the Bid adequate sums for work performed by installers whose qualifications meet those indicated in the Procurement and Contracting Documents.

1.4 ARTICLE 3 - BIDDING DOCUMENTS

- A. 3.4 - Addenda:
1. Delete Section 3.4.3 and replace with the following:
    - a. 3.4.3 - Addenda may be issued at any time prior to the receipt of bids.
  2. Add Section 3.4.4.1:

- a. 3.4.4.1 - Owner may elect to waive the requirement for acknowledging receipt of 3.4.4 Addenda as follows:
  - 1) 3.4.4.1.1 - Information received as part of the Bid indicates that the Bid, as submitted, reflects modifications to the Procurement and Contracting Documents included in an unacknowledged Addendum.
  - 2) 3.4.4.1.2 - Modifications to the Procurement and Contracting Documents in an unacknowledged Addendum do not, in the opinion of Owner, affect the Contract Sum or Contract Time.

1.5 ARTICLE 4 - BIDDING PROCEDURES

A. 4.1 - Preparation of Bids:

1. Add Section 4.1.9:

- a. 4.1.9 - Owner may elect to disqualify a bid due to failure to submit a bid in the form requested, failure to bid requested alternates or unit prices, failure to complete entries in all blanks in the Bid Form, or inclusion by the Bidder of any alternates, conditions, limitations or provisions not called for.

B. 4.2 - Bid Security:

1. Delete section 4.2.1 and replace with the following:

- a. Each Bid shall be accompanied by a bid security in the form and amount required in the bid documents and noted in 00 41 06.

C. 4.3 - Submission of Bids:

1. Delete section 4.3.1 and replace with the following:

- a. A Bidder shall submit paper copies its Bid, the bid security, and all other documents required by the bid documents.

2. Add Section 4.3.2.1:

- a. 4.3.2.1 - Include Bidder's Contractor License Number applicable in Project jurisdiction on the face of the sealed bid envelope.

D. 4.4 - Modification or Withdrawal of Bid:

1. Add the following sections to 4.4.1:

- a. 4.4.1.1 - Such modifications to or withdrawal of a bid may only be made by persons authorized to act on behalf of the Bidder. Authorized persons are those so identified in the Bidder's corporate bylaws, specifically empowered by the Bidder's charter or similar legally binding document acceptable to Owner, or by a power of attorney, signed and dated, describing the scope and limitations of the power of attorney. Make such documentation available to Owner at the time of seeking modifications or withdrawal of the Bid.

- b. 4.4.1.2 - Owner will consider modifications to a bid written on the sealed bid envelope by authorized persons when such modifications comply with the following: the modification is indicated by a percent or stated amount to be added to or deducted from the Bid; the amount of the Bid itself is not made known by the modification; a signature of the authorized person, along with the time and date of the modification, accompanies the modification. Completion of an unsealed bid form, awaiting final figures from the Bidder, does not require power of attorney due to the evidenced authorization of the Bidder implied by the circumstance of the completion and delivery of the Bid.

1.6 ARTICLE 5 - CONSIDERATION OF BIDS

A. 5.2 - Rejection of Bids:

1. Add Section 5.2.1:

- a. 5.2.1 - Owner reserves the right to reject a bid based on Owner's and Engineer's evaluation of qualification information submitted following opening of bids. Owner's evaluation of the Bidder's qualifications will include: status of licensure and record of compliance with licensing requirements, record of quality of completed work, record of Project completion and ability to complete, record of financial management including financial resources available to complete Project and record of timely payment of obligations, record of Project site management including compliance with requirements of authorities having jurisdiction, record of and number of current claims and disputes and the status of their resolution, and qualifications of the Bidder's proposed Project staff and proposed subcontractors.

1.7 ARTICLE 6 – POST-BID INFORMATION

A. 6.1 - Contractor's Qualification Statement:

1. Add Section 6.1.1:

- a. 6.1.1 - Submit Contractor's Qualification Statement no later than five days after the bid submittal.

1.8 ARTICLE 7 - PERFORMANCE BOND AND PAYMENT BOND

A. 7.1 - Bond Requirements:

1. Add Section 7.1.1.1:

- a. 7.1.1.1 – A Performance Bond will be required, in an amount equal to 100 percent of the Contract Sum.

B. 7.2 - Time of Delivery and Form of Bonds:

1. Delete the first sentence of Section 7.2.1 and insert the following:

- a. The Bidder shall deliver the required bonds to Owner no later than 10 days after the date of Notice of Intent to Award and no later than the date of execution of the Contract, whichever occurs first. Owner may deem the failure of the Bidder to deliver required bonds within the period of time allowed a default.

2. Delete Section 7.2.3 and insert the following:

- a. 7.2.3 - Bonds shall be executed and be in force on the date of the execution of the Contract.

1.9 ARTICLE 8 – ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

- A. The form of agreement between Owner and Contractor is included in specifications and is bound in this project manual.

1.10 ARTICLE 9 - EXECUTION OF THE CONTRACT

A. Add Article 9:

1. 9.1.1 - Subsequent to the Notice of Intent to Award, and within 10 days after the prescribed Form of Agreement is presented to the Awardee for signature, the Awardee shall execute and deliver the Agreement to Owner, in such number of counterparts as Owner may require.
2. 9.1.2 - Owner may deem as a default the failure of the Awardee to execute the Contract and to supply the required bonds when the Agreement is presented for signature within the period of time allowed.
3. 9.1.3 - Unless otherwise indicated in the Procurement and Contracting Documents or the executed Agreement, the date of commencement of the Work shall be the date of the executed Agreement or the date that the Bidder is obligated to deliver the executed Agreement and required bonds to Owner.
4. 9.1.4 - In the event of a default, Owner may declare the amount of the Bid security forfeited and elect to either award the Contract to the next responsible bidder or re-advertise for bids.

END OF DOCUMENT 00 22 13

DIVISION 0 – BIDDING AND CONTRACT REQUIREMENTS  
Section 00 22 44 - Additional Insurance Requirements

1.1 INSURANCE

The Contractor shall purchase and maintain insurance as required in the current edition of the Standard Form of Agreement Between Owner and Contractor where the Basis of Payment is a Stipulated Sum, AIA Document A101 and the General Condition of the Contract for Construction, AIA Document A201 as modified by these specifications, AIA General Conditions and Supplements to the AIA General Conditions, Article 11

- A. All of the above documents shall be thoroughly studied prior to purchases of an insurance policy to cover the Project.
- B. While not limited to the following requirements, the requirements listed below are brought to the Contractors Specific attention.
  - 1) Champaign County, and the Architect/Engineer shall be named as additional insureds on the Commercial General Liability Policy and the Umbrella Liability Policy.
  - 2) Waivers of Subrogation are required for both Property Insurance and for Liability Insurance.

1.2 ADDITIONAL LIABILITY INSURANCE REQUIREMENTS

In addition to the liability insurance requirements noted in Paragraph 1.01 above, the following requirements also apply:

- A. The Contractor shall purchase and maintain a Commercial General Liability Policy which shall include the following coverage areas:
  - 1) Operations of the Contractor - direct liability coverage for the Contractors activities at a permanent location and the Project Site;
  - 2) Operations of Subcontractors - Liability coverage for those entities for which the Contractor has a duty to supervise and stand legally responsible for their conduct;
  - 3) Completed Operations - Liability for property damage and bodily injury and death that occurs after Substantial Completion;
  - 4) Personal Injury - Including but not limited to, libel, slander, defamation of character, wrongful eviction, right of private occupancy, false arrest and detention and other similar personal injuries;
  - 5) Employees as Additional Insured - Include employees and their acts into the coverage;
  - 6) Explosion, Collapse, Underground - Liability coverage for the property of others to include, but not limited to, unknown utilities; and
  - 7) Contractual Liability - coverage for the assumption of others by Contract.
- B. The Commercial General Liability Policy shall name Champaign County, the Architect, the Architect's Consultants, their agents and employees as additional insured.
- C. The Contractor shall purchase and maintain Workers Compensation and Employees Liability Insurance.
- D. The Contractor shall purchase and maintain commercial Automobile Liability Insurance. This policy shall cover Owned, Non-owned and Hired vehicles.
- E. The Contractor shall purchase and maintain Umbrella Liability Coverage to provide higher limits of liability above those required for General Liability, Employers Liability and Automobile Liability.

- F. The Umbrella Liability Policy shall name Champaign County, the Architect, the Architect's Consultants, their agents and employees as additional insured.
  
- G. The Contractor shall purchase and maintain Owners Liability Insurance (Owners Protection Liability) which shall cover the Owners liability for all injuries and damages arising from the Project. This policy shall name the Architect and the Architect's Consultants, their agents and employees as additional insured.
  
- H. Liability limits shall be as specified herein or the maximum exposure as stated in the Government Tort Claims Acts as most recently amended, whichever is higher.
  
- I. The minimum amount of coverage and the limits of liability shall be as specified below:
  - 1) Claims under workers' or workman's compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed:
    - a. As required by law.
  
  - 2) Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees:
    - a. \$1,000,000.00
  
  - 3) Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees:
    - a. \$ 500,000.00
  
  - 4) Claims for damages insured by usual personal injury liability coverage which are sustained (1) by a person as a result of an offense directly or indirectly related to employment of such person by the Contractor, or (2) by another person:
    - a. \$1,000,000.00
  
  - 5) Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom:
    - a. \$ 500,000.00
  
  - 6) Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle:
    - a. \$1,000,000.00
  
  - 7) Claims involving contractual liability insurance applicable to the Contractor's obligations under Paragraph 3.18 of the General Conditions for the Contract for Construction as modified:
    - a. \$ 500,000.00

1.3 SUBMITTAL REQUIREMENTS

- A. Submit ACORD 25-S form along with the signed Agreement Between Owner and Contractor.
- B. Champaign County shall be listed as Certificate Holder.
- C. Include the following sentence under Special Items:

**"The Certificate Holder is Champaign County, Architect, Architect's Consultants, including their Agents and Employees are named as additional insured's in both the General and Umbrella Liability Policy. Waivers of Subrogation are in effect for both liability and property insurance policies."**

1.4 LOSS OF USE INSURANCE

- A. The Owner, at the Owners option, may purchase and maintain such insurance that will protect the Owner against the loss of use of this property.

END OF SECTION 00 22 44

DIVISION 0 – BIDDING AND CONTRACT REQUIREMENTS

Section 00 25 13 – Prebid Meeting

1.1 PREBID MEETING

- A. There will be a Prebid meeting as indicated below:
  - 1. Meeting Date: Friday, May 14, 2021
  - 2. Meeting Time: 2:00 P.M. CDT.
  - 3. Location: Brookens Administrative Center, 1776 East Washington Street, Urbana, IL 61802, Lyle Shields Meeting Room.
  
- B. Bidder Questions: Submit written questions to be addressed at Prebid meeting a minimum of two business days prior to meeting.
  
- C. Agenda: Prebid meeting agenda will include review of topics that may affect proper preparation and submittal of bids, including the following:
  - 1. Procurement and Contracting Requirements:
    - a. Instructions to Bidders.
    - b. Bidder Qualifications.
    - c. Bonding.
    - d. Insurance.
    - e. Bid Form and Attachments.
    - f. Bid Submittal Requirements.
    - g. Notice of Award.
  
  - 2. Communication during Bidding Period:
    - a. Obtaining documents.
    - b. Bidder's Requests for Information.
    - c. Bidder's Substitution Request/Prior Approval Request.
    - d. Addenda.
  
  - 3. Contracting Requirements:
    - a. Agreement.
    - b. The General Conditions.
    - c. The Supplementary Conditions.
    - d. Other Owner requirements.
  
  - 4. Construction Documents:
    - a. Scopes of Work.
    - b. Temporary Facilities.
    - c. Use of Site.
    - d. Work Restrictions.
    - e. Unit Price.
    - f. Substitutions following award.



5. Schedule:
    - a. Project Schedule.
    - b. Contract Time.
    - c. Other Bidder Questions.
  6. Site/facility visit or walkthrough.
  7. Post-Meeting Addendum.
- D. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes to attendees of prebid meeting only. Minutes of meeting are issued as Available Information and do not constitute a modification to the Procurement and Contracting Documents. Modifications to the Procurement and Contracting Documents are issued by written Addendum only.
1. Sign-in Sheet: Minutes will include list of meeting attendees.

END OF DOCUMENT 00 25 13

**RETURN WITH BID**

DIVISION 0 - BIDDING & CONTRACT REQUIREMENTS  
Document 00 41 06 – Bid Bond

\_\_\_\_\_  
\_\_\_\_\_  
as Principal, and  
a corporation of the State of \_\_\_\_\_  
as Surety, are held and firmly bound unto the Champaign County the amount of ten percent (10%) of the amount of the base  
bid for the payment of which Principal and Surety bind themselves, their heirs, executors, administrators, successors and  
assigns, jointly and severally, to this agreement.

Principal has submitted to Obligee a bid to enter into a written contract, for

Project Number: \_\_\_\_\_ Division of Work: \_\_\_\_\_  
in accordance with bidding documents for the project, which contract is by reference made a part hereof and is hereinafter  
referred to as "the Contract".

THE CONDITION OF THIS OBLIGATION is that if Principal, upon acceptance by Obligee of its bid within the period of time  
specified for acceptance, shall comply with all post award requirements as required by the terms of the bid within the time  
specified after date of the Notice of Award, or in the event of the failure to comply with all post award requirements, if Principal  
shall pay Obligee (1) for all costs of procuring the work which exceeds the amount of its bid, or (2) shall pay Obligee the  
amount of this bond as liquidated damages in the event Principal is a sole bidder and after an attempt to secure other bids by  
readvertising none can be obtained, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

Surety hereby agrees that its obligation shall not be impaired by any extensions of time for Obligee's acceptance or  
compliance with post award requirements. Surety hereby waives notice of such extensions.

Signed and sealed this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

\_\_\_\_\_  
CONTRACTOR

\_\_\_\_\_  
SURETY

BY \_\_\_\_\_  
SIGNATURE

BY \_\_\_\_\_  
OFFICER OF THE SURETY

Title \_\_\_\_\_

Title \_\_\_\_\_

ATTEST:

\_\_\_\_\_  
CORPORATE SECRETARY (Corporations only)

JURAT (Notary's Statement Authenticating Signature)

STATE OF \_\_\_\_\_

COUNTY OF \_\_\_\_\_

I, \_\_\_\_\_, a Notary Public in and for said county, do hereby certify that

**(Insert Name of Attorney-In-Fact for SURETY)**

who is personally known to me to be the same person whose name is subscribed to the foregoing instrument on behalf of  
SURETY, appeared before me this day in person and acknowledged respectively, that he/she signed, sealed, and delivered  
said instrument as his/her free and voluntary act for the uses and purposes therein set forth.

Given under my hand and notarial seal this \_\_\_\_\_ DAY OF \_\_\_\_\_ A.D. 20 \_\_\_\_\_

My commission expires \_\_\_\_\_

Notary Signature \_\_\_\_\_

DIVISION 0 – BIDDING AND CONTRACT REQUIREMENTS  
Section 00 41 13 – Bid Form – Stipulated Sum (Single-Prime Contract)

1.1 BID INFORMATION

- A. Bidder: \_\_\_\_\_.
- B. Project Name: Champaign County Courthouse Roof Replacement
- C. Project Location: 101 E. Main Street, Urbana, Illinois 61801
- D. Owner: Champaign County

1.2 CERTIFICATIONS AND BID

- A. **Base Bid, Single-Prime (All Trades) Contract:** The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by Bailey Edward Design, Inc., 1103 S. Mattis Avenue, Champaign, IL 61821, and their consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

1. \_\_\_\_\_ Dollars  
(\$ \_\_\_\_\_)

1.3 TIME OF COMPLETION

- A. Provided the contractor receives Notice to Proceed on or prior to July 2, 2021 the bidder agrees to be substantially complete with the Base Bid work on or before October 1, 2021.

1.4 ACKNOWLEDGEMENT OF ADDENDA

- A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:
  - 1. Addendum No. 1, dated \_\_\_\_\_.
  - 2. Addendum No. 2, dated \_\_\_\_\_.

1.5 SUBMISSION OF BID

A. In submitting the Bid, the undersigned agree that this Proposal will not be withdrawn for a period of thirty (30) calendar days from the date of submission. It is understood the Owner reserves the right to reject any and all Bids and to waive informalities and irregularities.

1. Respectfully submitted this \_\_\_\_ day of \_\_\_\_\_, 2021.
2. Submitted By : \_\_\_\_\_  
(Name of bidding firm or corporation).
3. Authorized Signature : \_\_\_\_\_  
(Handwritten signature).
4. Signed By : \_\_\_\_\_  
(Type or print name).
5. Title : \_\_\_\_\_  
(Owner/Partner/President/Vice President).
6. Witness By : \_\_\_\_\_  
(Handwritten signature).
7. Attest : \_\_\_\_\_  
(Handwritten signature).
8. By : \_\_\_\_\_  
(Type or print name).
9. Title : \_\_\_\_\_  
(Corporate Secretary or Assistant Secretary).
10. Street Address: \_\_\_\_\_.
11. City, State, Zip: \_\_\_\_\_.
12. Phone: \_\_\_\_\_.
13. License No.: \_\_\_\_\_.
14. Federal ID No. : \_\_\_\_\_

(Affix Corporate Seal Here).

END OF DOCUMENT 00 41 13

**RETURN WITH BID**

**BIDDER'S / CONTRACTOR'S  
DISCLOSURE AFFIDAVIT**

STATE OF ILLINOIS )  
 ) SS  
COUNTY OF \_\_\_\_\_ )

**BUSINESS STATUS STATEMENT**

I, the undersigned, being duly sworn, do state as follows:

A. \_\_\_\_\_ (hereafter "Contractor") is a:  
Company Name

(Place a mark in front of appropriate type of business)

\_\_\_\_\_ Corporation (If a Corporation, complete B)

\_\_\_\_\_ Partnership (If a Partnership, complete C)

\_\_\_\_\_ Individual Proprietorship (If an Individual, complete D)

**B. CORPORATION**

The State of Incorporation is \_\_\_\_\_

The registered agent of the Corporation in Illinois is:

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

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

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

Telephone: \_\_\_\_\_

The Corporate officers are as follows:

President: \_\_\_\_\_

Vice President: \_\_\_\_\_

Secretary: \_\_\_\_\_

Treasurer: \_\_\_\_\_

**RETURN WITH BID**

C. PARTNERSHIP

The Partners are as follows (attach additional sheets if necessary):

_____	_____
Name	Address
_____	_____
Name	Address
_____	_____
Name	Address
_____	_____
Name	Address

The business address is: \_\_\_\_\_

D. INDIVIDUAL PROPRIETORSHIP

The business address is: \_\_\_\_\_

Business Telephone: \_\_\_\_\_

My home address is: \_\_\_\_\_

Home Telephone: \_\_\_\_\_

E. Under penalty of perjury \_\_\_\_\_

(Contractor's Name)

Certifies that \_\_\_\_\_ (FEIN / SSN)  
is its correct Federal Taxpayer Identification Number, or in the case of an individual or sole proprietorship, Social Security Number.

**NON-DISCRIMINATION STATEMENT**

The Contractor does not and will not engage in discriminatory practices; the Contractor does not and will not engage in discrimination because of race, sex, age, religion, national origin or sensory, mental, or physical handicap in hiring or firing; and the Contractor is, in fact, an equal opportunity employer.

**RETURN WITH BID**

**NON-COLLUSION STATEMENT**

- A. That the only persons or corporations interested with \_\_\_\_\_  
(Name of Bidder)  
in the delivery of the materials and/or services bid upon under the Contract other than its officers,  
directors, shareholders and employees are:

_____ Name	_____ Address
_____ Name	_____ Address
_____ Name	_____ Address
_____ Name	_____ Address

- B. That the said Bid is made without any connection or common interest in the profits with any other persons making any Bid or Proposal for said Work except as listed above.
- C. That this Contract is in all respects fair and entered into without collusion or fraud.
- D. That no employee or any officer of the Owner has any financial interest, directly or indirectly, in the award of this Bid to Bidder except as listed above.
- E. That the Bidder is not barred from bidding on this Contract as a result of violation of either Section 33E-3 (Bid Rigging) or Section 33E-4 (Bid Rotating) of Chapter 38, Illinois Revised Statutes.
- F. The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees, or parties in interest, including this affiant.

**NO DELINQUENT ILLINOIS TAXES STATEMENT**

The undersigned certifies that the Contractor is not delinquent in payment of any tax administered by the Illinois Department of Revenue except that the taxes for which liability for the taxes or the amount of the taxes are being contested, in accordance with the procedure established by the appropriate Revenue Act; or the Contractor has entered into an agreement (2) with the Illinois Department of Revenue for the payment of all such taxes due and is in compliance with the agreement.

**RETURN WITH BID**

**FAMILIARITY WITH LAWS STATEMENT**

I, the undersigned, being duly sworn, do hereby state that \_\_\_\_\_  
(Company Name)  
is familiar with and will comply with all Federal, State and Local laws applicable to the Project, which include, but are not limited to, the Prevailing Wage Act and the Davis-Bacon Act.

**PENDING AND UNCOMPLETED WORK**

I, the undersigned, being duly sworn, do hereby declare that the following is a true and correct statement relating to **all** uncompleted contracts of the undersigned for Federal, State, County, City and private work, including **all** subcontract work; and all pending low BIDS not yet awarded or rejected:

Total Projects Under Contract \_\_\_\_\_  
Total Projects with Pending Low Bids \_\_\_\_\_  
Total Value of Projects Under Contract and Pending Low Bids \_\_\_\_\_

\_\_\_\_\_  
(Affiant's Signature) (Print Name & Title)  
\_\_\_\_\_  
(Company Name)

SUBSCRIBED and SWORN to before me this  
\_\_\_\_\_ day of \_\_\_\_\_, 2021

Notary Public

My Commission Expires: \_\_\_\_\_

(SEAL)

**INSTRUCTIONS:** This affidavit is to be completely filled out and executed by the chief officer of the Bidder authorized to submit the affidavit. Attach written explanation where applicable.





**RETURN WITH BID**

- D. Notify the Owner within 10 days after receiving notice under paragraph A.3.b. above from an employee or otherwise receiving actual notice of such conviction.
- E. Impose a sanction on, or require the satisfactory participation in a drug abuse assistance or rehabilitation program by any employee who is so convicted.
- F. Assist employees in selecting a course of action in the event drug counseling, treatment or rehabilitation is required and a trained referral team is in place.
- G. Make a good faith effort to continue to maintain a drug free workplace through implementation of the Drug Free Workplace Act.

If an individual, the Contractor certifies that it will not engage in the unlawful manufacture, distribution, dispensation, possession or use of a controlled substance in the performance of the Owner's contract.

The Contractor shall, within 30 days after receiving notice from an employee of a conviction of a violation of a criminal drug statute occurring in the workplace:

- A. Take appropriate personnel action against such employee up to and including termination; and
- B. Require the 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.

**Contractor:**

By: \_\_\_\_\_

Title: \_\_\_\_\_

SIGNED and SWORN to before me this

\_\_\_\_\_ day of \_\_\_\_\_, 2021.

\_\_\_\_\_  
Notary Public

DIVISION 0 - BIDDING & CONTRACT REQUIREMENT  
Section 00 43 43 – Prevailing Rate of Wages

1. PREVAILING WAGE ACT

- 1.1 Pursuant to Illinois Compiled Statutes 820 ILCS 130/0.01 et seq., these specifications list on the following pages, the Illinois Department of Labor prevailing rate of wages for the county where the contract is being performed and for each craft or type of worker needed to execute the contract.
- 1.2 Contractor shall submit certified payrolls with monthly application for payment.
- 1.3 A Project Labor Agreement is required for this project.

END OF SECTION 00 43 43

## Champaign County Prevailing Wage Rates posted on 3/15/2021

Trade Title	Rg	Type	C	Base	Foreman	Overtime				H/W	Pension	Vac	Trng	Other Ins
						M-F	Sa	Su	Hol					
ASBESTOS ABT-GEN	All	BLD		32.49	33.74	1.5	1.5	2.0	2.0	7.25	17.72	0.00	0.90	
ASBESTOS ABT-MEC	All	BLD		24.25	25.25	1.5	1.5	2.0	2.0	9.00	7.40	0.00	0.50	
BOILERMAKER	All	BLD		41.00	44.00	1.5	1.5	2.0	2.0	7.07	20.57	0.00	1.24	
BRICK MASON	All	BLD		33.14	34.80	1.5	1.5	2.0	2.0	8.60	15.80	0.00	0.88	
CARPENTER	All	BLD		37.11	39.36	1.5	1.5	2.0	1.5	8.90	15.25	0.00	0.70	
CARPENTER	All	HWY		37.85	39.60	1.5	1.5	2.0	2.0	8.90	16.20	0.00	0.67	
CEMENT MASON	All	BLD		34.16	36.66	1.5	1.5	2.0	2.0	9.85	11.05	0.00	0.50	
CEMENT MASON	All	HWY		35.20	37.20	1.5	1.5	2.0	2.0	9.85	11.55	0.00	0.50	
CERAMIC TILE FINISHER	All	BLD		32.13		1.5	1.5	2.0	2.0	8.60	11.80	0.00	0.30	
ELECTRIC PWR EQMT OP	All	ALL		47.70	56.60	1.5	1.5	2.0	2.0	7.93	13.36	0.00	0.72	
ELECTRIC PWR GRNDMAN	All	ALL		32.41	56.60	1.5	1.5	2.0	2.0	7.47	9.07	0.00	0.48	
ELECTRIC PWR LINEMAN	All	ALL		53.09	56.60	1.5	1.5	2.0	2.0	8.09	14.86	0.00	0.80	
ELECTRIC PWR TRK DRV	All	ALL		34.02	56.60	1.5	1.5	2.0	2.0	7.52	9.53	0.00	0.51	
ELECTRICIAN	All	BLD		43.83	48.21	1.5	1.5	2.0	2.0	7.25	10.92	0.00	0.66	
ELECTRONIC SYSTEM TECH	All	BLD		32.28	34.28	1.5	1.5	2.0	2.0	7.25	10.32	0.00	0.40	
ELEVATOR CONSTRUCTOR	All	BLD		49.32	55.49	2.0	2.0	2.0	2.0	15.87	19.31	3.95	0.64	
FENCE ERECTOR	All	ALL		34.34	36.24	1.5	1.5	2.0	2.0	11.59	13.02	0.00	1.11	
GLAZIER	All	BLD		36.51	38.51	1.5	1.5	2.0	2.0	6.45	11.45	0.00	0.68	
HEAT/FROST INSULATOR	All	BLD		32.85		1.5	1.5	2.0	2.0	7.99	13.24	0.00	0.35	0.50
IRON WORKER	All	ALL		34.34	36.24	1.5	1.5	2.0	2.0	11.59	13.02	0.00	1.11	
LABORER	All	BLD		29.99	31.24	1.5	1.5	2.0	2.0	7.25	17.72	0.00	0.80	
LABORER	All	HWY		32.59	33.59	1.5	1.5	2.0	2.0	7.25	17.80	0.00	0.80	
LATHER	All	BLD		37.11	39.36	1.5	1.5	2.0	2.0	8.90	15.25	0.00	0.70	
MACHINIST	All	BLD		49.68	52.18	1.5	1.5	2.0	2.0	7.93	8.95	1.85	1.47	
MARBLE FINISHER	All	BLD		32.13		1.5	1.5	2.0	2.0	8.60	11.80	0.00	0.30	
MARBLE MASON	All	BLD		33.65		1.5	1.5	2.0	2.0	8.60	11.80	0.00	0.30	
MILLWRIGHT	All	BLD		33.06	35.31	1.5	1.5	2.0	2.0	8.90	19.76	0.00	0.70	
MILLWRIGHT	All	HWY		36.40	38.15	1.5	1.5	2.0	2.0	8.90	20.52	0.00	0.67	
OPERATING ENGINEER	All	ALL	1	42.25	43.25	1.5	1.5	2.0	2.0	10.35	11.45	0.00	1.20	
OPERATING ENGINEER	All	ALL	2	27.15	43.25	1.5	1.5	2.0	2.0	10.35	11.45	0.00	1.20	
OPERATING ENGINEER	All	ALL	3	43.25	44.25	1.5	1.5	2.0	2.0	10.35	11.45	0.00	1.20	

PAINTER	All	ALL		36.11	37.61	1.5	1.5	2.0	2.0	9.85	6.38	0.00	0.60	
PAINTER - SIGNS	All	ALL		36.11	37.61	1.5	1.5	2.0	2.0	9.85	6.38	0.00	0.60	
PILEDRIIVER	All	BLD		38.11	40.36	1.5	1.5	2.0	2.0	8.90	15.25	0.00	0.70	
PILEDRIIVER	All	HWY		37.85	39.60	1.5	1.5	2.0	2.0	8.90	16.20	0.00	0.67	
PIPEFITTER	All	BLD		46.12	48.98	1.5	1.5	2.0	2.0	7.75	10.25	0.00	2.06	
PLASTERER	All	BLD		34.05	36.05	1.5	1.5	2.0	2.0	9.85	12.85	0.00	0.50	
PLUMBER	All	BLD		46.12	48.98	1.5	1.5	2.0	2.0	7.75	10.25	0.00	2.06	
ROOFER	All	BLD		34.18	37.18	1.5	1.5	2.0	2.0	9.64	8.65	0.00	0.36	
SHEETMETAL WORKER	All	BLD		38.63	40.88	1.5	1.5	2.0	2.0	9.45	15.75	0.00	0.52	1.92
SPRINKLER FITTER	All	BLD		41.97	44.72	1.5	1.5	2.0	2.0	10.23	14.02	0.00	0.52	
STONE MASON	All	BLD		33.14	34.80	1.5	1.5	2.0	2.0	8.60	15.80	0.00	0.88	
TERRAZZO FINISHER	All	BLD		32.13		1.5	1.5	2.0	2.0	8.60	11.80	0.00	0.30	
TERRAZZO MASON	All	BLD		33.65		1.5	1.5	2.0	2.0	8.60	11.80	0.00	0.30	
TILE MASON	All	BLD		33.65		1.5	1.5	2.0	2.0	8.60	11.80	0.00	0.30	
TRUCK DRIVER	All	ALL	1	38.93	43.17	1.5	1.5	2.0	2.0	13.52	6.62	0.00	0.25	
TRUCK DRIVER	All	ALL	2	39.50	43.17	1.5	1.5	2.0	2.0	13.52	6.62	0.00	0.25	
TRUCK DRIVER	All	ALL	3	39.77	43.17	1.5	1.5	2.0	2.0	13.52	6.62	0.00	0.25	
TRUCK DRIVER	All	ALL	4	40.14	43.17	1.5	1.5	2.0	2.0	13.52	6.62	0.00	0.25	
TRUCK DRIVER	All	ALL	5	41.21	43.17	1.5	1.5	2.0	2.0	13.52	6.62	0.00	0.25	
TRUCK DRIVER	All	O&C	1	31.14	34.54	1.5	1.5	2.0	2.0	13.52	6.62	0.00	0.25	
TRUCK DRIVER	All	O&C	2	31.60	34.54	1.5	1.5	2.0	2.0	13.52	6.62	0.00	0.25	
TRUCK DRIVER	All	O&C	3	31.82	34.54	1.5	1.5	2.0	2.0	13.52	6.62	0.00	0.25	
TRUCK DRIVER	All	O&C	4	32.11	34.54	1.5	1.5	2.0	2.0	13.52	6.62	0.00	0.25	
TRUCK DRIVER	All	O&C	5	32.97	34.54	1.5	1.5	2.0	2.0	13.52	6.62	0.00	0.25	
TUCKPOINTER	All	BLD		33.14	34.80	1.5	1.5	2.0	2.0	8.60	15.80	0.00	0.88	

**Legend**

**Rg** Region

**Type** Trade Type - All,Highway,Building,Floating,Oil & Chip,Rivers

**C** Class

**Base** Base Wage Rate

**OT M-F** Unless otherwise noted, OT pay is required for any hour greater than 8 worked each day, Mon through Fri. The number listed is the multiple of the base wage.

**OT Sa** Overtime pay required for every hour worked on Saturdays

**OT Su** Overtime pay required for every hour worked on Sundays

**OT Hol** Overtime pay required for every hour worked on Holidays

**H/W** Health/Welfare benefit

**Vac** Vacation

## **Trng Training**

**Other Ins** Employer hourly cost for any other type(s) of insurance provided for benefit of worker.

### Explanations CHAMPAIGN COUNTY

The following list is considered as those days for which holiday rates of wages for work performed apply: New Years Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day, Christmas Day and Veterans Day in some classifications/counties. Generally, any of these holidays which fall on a Sunday is celebrated on the following Monday. This then makes work performed on that Monday payable at the appropriate overtime rate for holiday pay. Common practice in a given local may alter certain days of celebration. If in doubt, please check with IDOL.

Oil and chip resealing (O&C) means the application of road oils and liquid asphalt to coat an existing road surface, followed by application of aggregate chips or gravel to coated surface, and subsequent rolling of material to seal the surface.

### EXPLANATION OF CLASSES

ASBESTOS - GENERAL - removal of asbestos material/mold and hazardous materials from any place in a building, including mechanical systems where those mechanical systems are to be removed. This includes the removal of asbestos materials/mold and hazardous materials from ductwork or pipes in a building when the building is to be demolished at the time or at some close future date.

ASBESTOS - MECHANICAL - removal of asbestos material from mechanical systems, such as pipes, ducts, and boilers, where the mechanical systems are to remain.

### CERAMIC TILE FINISHER, MARBLE FINISHER, TERRAZZO FINISHER

Assisting, helping or supporting the tile, marble and terrazzo mechanic by performing their historic and traditional work assignments required to complete the proper installation of the work covered by said crafts. The term "Ceramic" is used for naming the classification only and is in no way a limitation of the product handled. Ceramic takes into consideration most hard tiles.

### ELECTRONIC SYSTEMS TECHNICIAN

Installation, service and maintenance of low-voltage systems which utilizes the transmission and/or transference of voice, sound, vision, or digital for commercial, education, security and entertainment purposes for the following: TV monitoring and surveillance, background/foreground music, intercom and telephone interconnect, field programming, inventory control systems, microwave transmission, multi-media, multiplex, radio page, school, intercom and sound burglar alarms and low voltage master clock systems.

Excluded from this classification are energy management systems, life safety systems, supervisory controls and data acquisition systems not intrinsic with the above listed systems, fire alarm systems, nurse call systems and raceways exceeding fifteen feet in length.

TRUCK DRIVER - BUILDING, HEAVY AND HIGHWAY CONSTRUCTION Class 1. Drivers on 2 axle trucks hauling less than 9 ton. Air compressor and welding machines and brooms, including those pulled by separate units, truck driver helpers, warehouse employees, mechanic helpers, greasers and tiremen, pickup trucks when hauling materials, tools, or workers to and from and on-the-job site, and fork lifts up to 6,000 lb. capacity.

Class 2. Two or three axle trucks hauling more than 9 ton but hauling less than 16 ton. A-frame winch trucks, hydrolift trucks, vactor trucks or similar equipment when used for transportation purposes. Fork lifts over 6,000 lb. capacity, winch trucks, four

axle combination units, and ticket writers.

Class 3. Two, three or four axle trucks hauling 16 ton or more. Drivers on water pulls, articulated dump trucks, mechanics and working forepersons, and dispatchers. Five axle or more combination units.

Class 4. Low Boy and Oil Distributors.

Class 5. Drivers who require special protective clothing while employed on hazardous waste work.

#### TRUCK DRIVER - OIL AND CHIP RESEALING ONLY.

This shall encompass laborers, workers and mechanics who drive contractor or subcontractor owned, leased, or hired pickup, dump, service, or oil distributor trucks. The work includes transporting materials and equipment (including but not limited to, oils, aggregate supplies, parts, machinery and tools) to or from the job site; distributing oil or liquid asphalt and aggregate; stock piling material when in connection with the actual oil and chip contract. The Truck Driver (Oil & Chip Resealing) wage classification does not include supplier delivered materials.

OPERATING ENGINEERS - BUILDING, HEAVY AND HIGHWAY CONSTRUCTION Class 1. Draglines, Derricks, Shovels, Gradalls, Mechanics, Tractor Highlift, Tournadozer, Concrete Mixers with Skip, Tournamixer, Two Drum Machine, One Drum Hoist with Tower or Boom, Cableways, Tower Machines, Motor Patrol, Boom Tractor, Boom or Winch Truck, Winch or Hydraulic Boom Truck, Tournapull, Tractor Operating Scoops, Bulldozer, Push Tractor, Asphalt Planer, Finishing Machine on Asphalt, Large Rollers on Earth, Rollers on Asphalt Mix, Ross Carrier or similar Machine, Gravel Processing Machine, Asphalt Plant Engineer, Paver Operator, Dredging Equipment, or Dredge Engineer, or Dredge Operator, Central Mix Plant Engineer, CMI or similar type machine, Concrete Pump, Truck or Skid Mounted, Engineer or Rock Crusher Plant, Concrete Plant Engineer, Ditching Machine with dual attachment, Tractor Mounted Loaders, Hydro Crane, Standard or Dinkey Locomotives, Scoopmobiles, Euclid Loader, Soil Cement Machine, Back Filler, Elevating Machine, Power Blade, Drilling Machine, including Well Testing, Caissons, Shaft or any similar type drilling machines, Motor Driven Paint Machine, Pipe Cleaning Machine, Pipe Wrapping Machine, Pipe Bending Machine, Apsco Paver, Boring Machine, (Head Equipment Greaser), Barber-Greene Loaders, Formless Paver, (Well Point System), Concrete Spreader, Hydra Ax, Span Saw, Marine Scoops, Brush Mulcher, Brush Burner, Mesh Placer, Tree Mover, Helicopter Crew (3), Piledriver-Skid or Crawler, Stump Remover, Root Rake, Tug Boat Operator, Refrigerating Machine, Freezing Operator, Chair Cart- Self-Propelled, Hydra Seeder, Straw Blower, Power Sub Grader, Bull Float, Finishing Machine, Self-Propelled Pavement Breaker, Lull (or similar type Machine), Two Air Compressors, Compressors hooked in Manifold, Chip Spreader, Mud Cat, Sull-Air, Fork Lifts (except when used for landscaping work), Soil Stabilizer (Seaman Tiller, Bo Mag, Rago Gator, and similar types of equipment), Tube Float, Spray Machine, Curing Machine, Concrete or Asphalt Milling Machine, Snooper Truck-Operator, Backhoe, Farm Tractors (with attachments), 4 Point Lift System (Power Lift or similar type), Skid-Steer (Bob Cat or similar type), Wrecking Shears, Water Blaster.

Class 2. Concrete Mixers without Skips, Rock Crusher, Ditching Machine under 6', Curbing Machine, One Drum Machines without Tower or Boom, Air Tugger, Self-Propelled Concrete Saw, Machine Mounted Post Hole Digger, two to four Generators, Water Pumps or Welding Machines, within 400 feet, Air Compressor 600 cu. ft. and under, Rollers on Aggregate and Seal Coat Surfaces, Fork Lift (when used for landscaping work), Concrete and Blacktop Curb Machine, One Water Pump, Oilers, Air Valves or Steam Valves, One Welding Machine, Truck Jack, Mud Jack, Gunnite Machine, House Elevators when used for hoisting material, Engine Tenders, Fireman, Wagon Drill, Flex Plane, Conveyor, Siphons and Pulsometer, Switchman, Fireman on Paint Pots, Fireman on Asphalt Plants, Distributor Operator on Trucks, Tampers, Self-Propelled Power Broom, Striping Machine (motor driven), Form Tamper, Bulk Cement Plant, Equipment Greaser, Deck Hands, Truck Crane Oiler-Driver, Cement Blimps, Form Grader, Temporary Heat, Throttle Valve, Super Sucker (and similar type of equipment).

Class 3. Power Cranes, Truck or Crawler Crane, Rough Terrain Crane (Cherry Picker), Tower Crane, Overhead Crane.

Other Classifications of Work:

For definitions of classifications not otherwise set out, the Department generally has on file such definitions which are available. If

a task to be performed is not subject to one of the classifications of pay set out, the Department will upon being contacted state which neighboring county has such a classification and provide such rate, such rate being deemed to exist by reference in this document. If no neighboring county rate applies to the task, the Department shall undertake a special determination, such special determination being then deemed to have existed under this determination. If a project requires these, or any classification not listed, please contact IDOL at 217-782-1710 for wage rates or clarifications.

#### LANDSCAPING

Landscaping work falls under the existing classifications for laborer, operating engineer and truck driver. The work performed by landscape plantsman and landscape laborer is covered by the existing classification of laborer. The work performed by landscape operators (regardless of equipment used or its size) is covered by the classifications of operating engineer. The work performed by landscape truck drivers (regardless of size of truck driven) is covered by the classifications of truck driver.



DIVISION 1 - GENERAL REQUIREMENTS  
Section 01 11 00 – Project Summary

1. GENERAL

1.1 WORK INCLUDED

A. Contractor shall provide all labor and materials associated with the work of this section, including:

1. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Coordination with occupants.
5. Work restrictions.
6. Specification and drawing conventions.

1.2 PROJECT INFORMATION

A. Project Identification:

1. Champaign County Courthouse Roof Replacement  
101E. Main Street, Urbana, Illinois 61801

B. Owner's Representative: Champaign County.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Base Scope: The base bid work includes removal and replacement of the existing asphalt roof system at the original building and addition. Existing sheet metal flashings and copings as indicated on Drawings to be removed and replaced. Hail damaged areas of copper copings and valley flashings to be replaced with like material.

2. PRODUCTS (NOT APPLICABLE)

3. EXECUTION (NOT APPLICABLE)

END OF SECTION 01 11 00

DIVISION 1 - GENERAL REQUIREMENTS  
Section 01 32 00 - Construction Schedule

1. GENERAL

1.1 REQUIREMENTS INCLUDE:

- A. The General Contractor shall prepare and maintain a detailed project schedule as described below.
- B. The project schedule shall be the Contractor's working schedule; used to execute the work and record and report actual progress. It shall show how the Contractor plans to complete the work within the contract time and meet any contractually specified intermediate milestone dates.

1.2 RELATED REQUIREMENTS

- A. Specified Elsewhere:
  - 1. Section 01 11 00 - Project Summary
  - 2. Section 01 33 23 - Shop Drawings, Product Data and Samples

1.3 FORM OF SCHEDULE

- A. The schedule shall provide sufficient detail and clarity so that the General Contractor can plan and control the work and the Owner and the A/E can readily monitor and follow the progress of all portions of the work. The critical activities must be clearly shown. The degree of detail must be satisfactory to the A/E and the Owner.
- B. The project schedule shall be in the form of a Gantt chart, and shall indicate the critical path, including durations.

1.4 CONTENTS OF SCHEDULE

- A. The schedule must be inclusive of all installation tasks of the work.
- B. Submittal and approval of shop drawings and material samples as well as delivery dates of major equipment shall be included in the project schedule.
- C. Activity duration shall be in whole working days.
- D. There should be at least one activity for each specification section.

1.5 UPDATING

- A. The project schedule shall be updated monthly.
- B. Actual activity completion dates shall be reported and recorded on the schedule.
- C. Progress on uncompleted activities shall be reported.
- D. Projected completion dates and activities shall be reviewed and revised if necessary.

1.6 REPORTS AND SUBMITTALS

- A. Within 15 days of the Authorization to Proceed, the Contractor shall submit the project schedule to the A/E and the Owner.
- B. Five (5) days prior to the pay/progress meeting, the contractor shall submit the current updated schedule to the A/E and the Owner.

1.7 REVIEWS

- A. Payment and reduction of retainage may be denied by the Owner for failure to submit a proper schedule and maintaining work progress according to the project schedule.

2. PRODUCTS

(NOT APPLICABLE)

3. EXECUTION

(NOT APPLICABLE)

END OF SECTION 01 32 00

DIVISION 1 - GENERAL REQUIREMENTS  
Section 01 33 23 - Shop Drawings, Product Data & Samples

1. GENERAL

1.1 REQUIREMENTS INCLUDE

- A. The Sub-contractor shall make submittals to the General Contractor. The General Contractor shall maintain a master list of submittals.
- B. Submittals shall be complete and legible. Incomplete submittals will be returned and not reviewed.

1.2 GENERAL CONTRACTOR:

- A. Review Sub-contractor's submittals within 5 business days.
  - 1. Verify field dimensions.
  - 2. Verify compliance with Contract requirements.

1.3 RELATED REQUIREMENTS

- A. Specified elsewhere:
  - 1. Submittal specific to each section are further outlined within the technical submittals as such within submittal package. Submittals deemed incomplete or not indication supplied by separate sub, shall be returned without review.

1.4 DEFINITIONS

- A. Shop drawings: Shop drawings are original drawings prepared by Contractor, subcontractor, sub-subcontractor, supplier or distributor, which illustrated some portion of the work, showing fabrication, layout, setting or erection details.
  - 1. Prepared by qualified detailer.
  - 2. Identify details by reference to sheet and detail numbers shown on contract drawings.
  - 3. Maximum sheet size: 30" x 42"
  - 4. Submit a maximum of (5) copies. Electronic copies of submittals are preferred.
- B. Product data:
  - 1. Manufacturer's standard schematic drawings edited to fit this project.
  - 2. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data.
    - a. Clearly mark each copy to identify pertinent materials, products or models.
    - b. Show dimensions and clearances.
    - c. Show wiring diagrams and controls.
- C. Samples: Physical samples to illustrate materials, equipment or workmanship. Approved samples establish standards by which complete work is judged. Maintain at site as directed. Protect until no longer needed.
  - 1. Office samples: Of sufficient size to clearly illustrate:
    - a. Functional characteristics of product or material.
    - b. Full range of color samples.
    - c. After review, samples may be used on construction of project.

2. Field samples and mock-ups:
  - a. Erect at project site at location approved by the Architect.
  - b. Construct each sample or mock-up complete, including work of all crafts required in finished work.
  - c. Remove as directed.

#### 1.5 SCHEDULE SUBMITTAL

- A. Submit schedule of all exhibits to Architect/Engineer within fifteen (15) business days after preconstruction meeting.

1. Prepare schedule in bar chart format, Include:
  - a. Exhibit identification
  - b. Specification section and page number
  - c. Date of submittal to Architect/Engineer
  - d. Latest date for final approval
  - e. Fabrication time.
  - f. Date of Installation
2. Architect/Engineer will review and comment on exhibit schedule and will advise the Contractor as to which submittals require longer review durations.

Submit number of copies of shop drawings, product data and samples which contractor requires for distribution plus (2) copies which will be retained by Architect/Engineer.

- B. Accompany submittals with transmittal letter, in duplicate, containing.

1. Date
2. Project title and number
3. Contractor's name and address.
4. The number of shop drawings, product data and samples submitted.
5. Notification of deviations from Contract.
6. Other pertinent data.

- C. Submittals shall include:

1. Date and revision
2. Project title and number
3. Name of:
  - a. Architect/ Engineer
  - b. Architect/ Engineer consultant
  - c. Subcontractor
  - d. Sub-subcontractor
  - e. Supplier
  - f. Manufacturer
  - g. Separate detailer when pertinent
4. Identification of product or material.
5. Relation to adjacent structure or material.
6. Field dimensions clearly identified as such.
7. Specification section and page number.
8. Specified standards, such as ASTM number or ANSI.

9. A blank space, (5"x5"), for Architect/Engineer's stamp.
  10. Identification of previously approved deviation(s) from contract documents.
  11. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of field measurements and compliance with Contract.
  12. Space for Contractor's approval stamp.
- D. Electronic Submittals: All submittals may be submitted electronically except for those specifically listing a requirement for paper submittals or physical samples. Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single file (pdf format) incorporating submittal requirements of a single Specification Section and transmittal form. Only complete submittals will be accepted.
  2. Name file with submittal number or other unique identifier, including revision identifier.
    - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g.; PROJNAME\_061000.01). Resubmittals shall include an alphabetic suffix after the decimal point (e.g.; PROJNAME\_061000.01A)
  3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Using Agency/ Architect/ Engineer.
  4. Transmittal Cover Sheet Form for Electronic Submittals: As described by the Architect and containing all information as indicated above for paper submittals.

#### 1.6 RESUBMISSION REQUIREMENTS

- A. Resubmit all shop drawings, product data, and samples as requested by the Contractor and/or A/E.

#### 1.7 RESPONSIBILITIES

- A. Review shop drawings, product data and samples prior to submission to the next level of authority. Review Subcontractor's submittals within five (5) business days. Certify review and transmit to Architect.
- B. Verify:
1. Field dimensions.
  2. Field construction criteria.
  3. Catalog numbers and similar data.
  4. Verify compliance with contract documents.
- C. Coordinate each submittal with requirements of:
1. The work.
  2. The contract documents.
  3. The work of other contractors.
  4. The existing conditions indicated to remain.
- D. Contractor's responsibility for errors, omissions or deviation from contract documents in submittals is not relieved by the Architect/Engineer's review of submittals.
- E. Prior to submission, notify the Architect/Engineer in writing of all proposed deviations in submittals from Contract requirements. Substitution of materials or equipment may only be approved by change order.
- F. Do not begin any work which requires submittals without Architect/Engineer's approval.
- G. After Architect/Engineer's review, make response required by A/E's stamp and distribute copies. Indicate by transmittal that copy of approved data has been delivered to installer.

1.8 ARCHITECT/ENGINEER'S RESPONSIBILITIES

- A. Review submittals within fourteen (14) calendar days.
- B. Review for:
  - 1. Design concept of project.
  - 2. Compliance with Contract Documents.
- C. Review all requests for proposed deviations.
- D. Affix stamp, date and initials or signature certifying review of submittal, and with instructions for the Contractor.
- E. Return submittals to sender for response or distribution.

2. PRODUCTS  
(NOT APPLICABLE)

3. EXECUTION  
(NOT APPLICABLE)

END OF SECTION 01 33 23

DIVISION 1 - GENERAL REQUIREMENTS  
Section - 01 35 16 - Remodeling Project Procedures

1. GENERAL

1.1 REQUIREMENTS INCLUDE

A. Each Contractor:

1. Coordinate work of employees and subcontractors.
2. Schedule elements of remodeling and renovation work to expedite completion.
3. Schedule noisy or hazardous work to avoid problems with Owner's operations.
4. In addition to demolition, cut, move or remove existing construction to provide access or to allow remodeling and new work to proceed. Include:
  - a. Repair or remove hazardous or unsanitary conditions.
  - b. Remove abandoned piping, conduit and wiring.
  - c. Remove unsuitable or extraneous materials not marked for salvage, such as rotted wood, brick paving, rusted metals and deteriorated concrete.
5. Patch, repair and refinish existing items to remain, to the specified condition for each material, with a neat transition to adjacent new or restored construction.
6. Note or record existing project conditions before beginning work to minimize later disputes.

1.2 RELATED REQUIREMENTS

A. Specified elsewhere:

1. 01 32 00 - Construction Schedules.
2. 01 51 50 - Use of Existing Facilities
3. 01 73 29 - Cutting & Patching
4. 01 74 13 - Construction Cleaning
5. 01 74 23 - Final Cleaning.

1.3 SEQUENCE AND SCHEDULES

A. Submit separate detailed sub-schedule for alterations work, coordinated with Construction Schedule. Show:

1. Each stage of work; occupancy dates of areas.
2. Date of Substantial Completion for each area of alteration work.
3. Crafts and subcontractors employed in each stage.

1.4 ALTERATIONS, CUTTING AND PROTECTION

A. Cut finish surfaces by methods to terminate surfaces in a straight line at a natural point of division.

2. PRODUCTS (NOT USED)



3. EXECUTION

3.1 REMOVE EXISTING CONSTRUCTION

A. Temporary Removals:

1. Remove all items as noted on the drawings or otherwise required to complete the work shown.
2. Store all items as noted on the drawings or otherwise required to complete the work shown.
3. Recondition all existing items as noted on the drawings or otherwise required to complete the work shown.
4. Reinstall all as noted on the drawings or otherwise required to complete the work shown.

B. Remove and dispose of existing items as noted on Drawings.

3.2 PERFORMANCE. Patch and extend existing work using skilled craftsmen capable of matching existing quality of workmanship. For patched or extended work, provide quality equal to that specified for new work.

3.3 DAMAGED SURFACES

A. Patch and replace all portions of existing finished surfaces found to be damaged, lifted, discolored or showing other imperfections, with matching material.

1. Provide adequate support prior to patching the finish.
2. Refinish patched portions of painted or coated surfaces in a manner to produce uniform color and texture over entire surface.
3. When existing surface cannot be matched, refinish entire surface to nearest intersections or change of direction.

3.4 TRANSITION FROM EXISTING TO RESTORED WORK

A. When restored work abuts or finishes flush with existing work, make a smooth transition. Patched work shall match existing adjacent work in texture and appearance.

1. When finished surfaces are cut in such a way that a smooth transition with restored work is not possible, terminate existing surface in a neat manner along a straight line at a natural line of division, and provide trim appropriate to finished surface.

3.5 CLEANING

A. Perform construction cleaning as specified in 01 74 13 and as follows:

1. Clean User occupied areas daily.
2. Clean all spillage, overspray or heavy dust collections in User occupied areas immediately.

B. At completion of work of each craft, clean area and make surfaces ready for work of successive crafts.

- C. At completion of alterations work in each area, provide final cleaning in accord with 01 74 23 and return space to a condition suitable for use of User.

END OF SECTION 01 35 16

DIVISION 1 - GENERAL REQUIREMENTS  
Section - 01 51 50 - Use of Existing Facilities

1. GENERAL

- 1.1 The project will be constructed at an occupied facility. These requirements supplement and other sections of the Project Manual.
- 1.2 The Owner and public will continue use of the County Courthouse through construction. Some limited closure or barricades are expected for portions of the work. Contractor is responsible for coordinating all closures with Champaign County and the Using Agency, as necessary.
- 1.3 REQUIREMENTS INCLUDE - Contractor provide:
  - A. Scheduling
  - B. Security and site regulations
  - C. Entrances (if required)
  - D. Construction aids
  - E. Temporary enclosures and barriers
  - F. Fences
  - G. Temporary utilities
  - H. Construction Cleaning
  - I. Storage
  - J. Close-out

2. EXECUTION

2.1 SCHEDULING

- A. Schedule the work to allow the Owner to use the facility with as minimal impact as possible. Submit separate detailed subschedule showing:
  - 1. Staging of work and occupancy dates.
- B. Schedule noisy or hazardous work to avoid problems with Owner's operations.

2.2 SECURITY AND SITE REGULATIONS

- A. Confer with the Owner's representative and obtain full knowledge of all site rules and regulations affecting work.

2.3 ENTRANCES Public entrances shall remain open. Contractor shall provide overhead protection where indicated on Drawings to protect employees and general public. Contractor shall not be permitted day to day access into the building.

2.4 CONSTRUCTION AIDS: Except as noted, Contractor provide and maintain construction aids and equipment for common use and to facilitate execution of the work.

- 2.5 TEMPORARY ENCLOSURES AND BARRIERS - Contractor:
- A. Provide temporary enclosures to separate work areas from existing parking and from areas occupied by Owner.
  - B. Provide and maintain suitable barriers to prevent unauthorized entry, and to protect the work.
- 2.6 TEMPORARY UTILITIES
- A. Contractor shall provide and pay for extension or modification of services to perform the work, and for restoration of services at completion of work.
- 2.7 ACCESS ROADS & PARKING AREAS
- A. Limit any loading of existing paved areas to 4000 p.s.i. maximum.
  - B. Use of existing parking facilities for construction personnel or for contractor's vehicles or equipment is not permitted.
  - C. Maintain roads, walks and parking areas in a sound, clean condition. Restore areas, damaged by construction operations, not in contract to original condition upon work completion prior to Final Acceptance.
  - D. Control vehicular parking to preclude interference with public traffic or parking, access by emergency vehicles, Owner's operations or construction operations.
  - E. Coordinate any temporary construction vehicle entrance onto the property for deliveries or access with the Owner a minimum of (3) days prior to the necessity.
  - F. Equipment with bearing pressure above 4000 psi shall not be allowed on the grounds or paving.
- 2.8 TRAFFIC REGULATION Contractor provide traffic control and directional signs, mounted on barricades or standard posts:
- A. At each change of direction of a roadway and at parking areas.
  - B. Provide qualified and suitably equipped flaggers when construction operations encroach on traffic lanes, as required for traffic regulation.
  - C. Where contractor requires sidewalk closure to execute scope of work, permits and alternative access for pedestrians shall be provided in the work of this contract.
- 2.9 CONSTRUCTION CLEANING
- A. Each Contractor provide cleaning and disposal of waste materials, debris and rubbish during construction.
  - B. Coordinating Contractor to supervise and coordinate cleaning operations of all Assigned Contractors.
  - C. Each Contractor provide covered containers for deposit of waste materials, debris and rubbish.

2.10 STORAGE Make arrangements with Owner's Representative for any on-site storage of materials and equipment to be installed in project. Protection and security for stored materials and equipment is solely contractor's responsibility.

2.11 CLOSEOUT

- A. Upon completion of need to use existing user-provided facilities, or when directed by Architect/Engineer, restore each to original or specified condition.
- B. At completion of work in each area, provide final cleaning and return space to a condition suitable for use of Owner.

END OF SECTION 01 51 50

DIVISION 1 – GENERAL REQUIREMENTS  
SECTION 01 54 00 – CONSTRUCTION AIDS

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDE

- A. Contractor shall provide all labor and material to install and maintain construction aids and equipment for all personnel use and to facilitate execution of the work:
  - 1. Ladders, working platforms and Scaffolding/Fall Protection.
  - 2. Heavy Equipment.
  - 3. Temporary enclosures, electrical power & water services, etc.
  - 4. Construction Barriers, and dust/noise/fume separations.
  - 5. Platforms.
  - 6. Stairs.
  - 7. Power and hand tools.
- B. Each Contractor must comply with OSHA regulations as they relate to these construction aids and all applicable standards.
- C. See respective specification sections for particular requirements.
- D. Provide and maintain for own forces all other construction aids required to complete his work.
- E. Remove all construction aids upon completion of the work, or as directed.

1.2 RELATED REQUIREMENTS

- A. Specified elsewhere:
  - 1. Section 01 10 00 - Project Summary.
  - 2. Section 01 51 00 - Temporary Utilities.
  - 3. Section 01 74 23 - Final Cleaning.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials may be new or used, suitable for purpose. Comply with specified codes, standards, and regulations.

2.2 CONSTRUCTION AIDS

- A. Maintain facilities and equipment in first class condition.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Consult with Architect and Owner, review site conditions and factors which affect construction procedures and construction aids, including adjacent occupied areas which may be affected by execution of the work.
- B. Coordinate with Owner for placement of barriers to maintain Owner operations, while protecting occupants from exposure to dust, noise, and fumes.

3.2 INSTALLATION

- A. Comply with respective Project Manual Specification Sections.
- B. Relocate construction aids as construction progresses to expedite storage or work and to accommodate legitimate requirements of the Owner and other contractors at the site.

3.3 REMOVAL:

- A. Completely remove temporary materials, equipment and services:
  - 1. When construction needs can be met by authorized use of permanent construction.
  - 2. At project completion.
- B. Clean and repair damage caused by installation or use of temporary facilities.
- C. Restore existing facilities used for temporary purposes to original condition.

END OF SECTION 01 54 00

DIVISION 1 – GENERAL REQUIREMENTS  
SECTION 01 56 00 - TEMPORARY BARRIERS AND ENCLOSURES

PART I - GENERAL

1.1 WORK INCLUDES

- A. Base Bid: Use of Barriers and Enclosures: The Contractor shall provide all labor and materials necessary to furnish, erect and maintain temporary barriers, barricades, enclosures, and temporary construction fencing as required for the following:
  - 1. To provide weather tight protection of building as roofing or deck is removed as part of the work in contract.
  - 2. To protect the health and safety of occupants and the general public from exposure to immediate physical harm as well as to noise, dust, and fumes. Note that this Section does not provide minimum requirements related to Indoor Air Quality.
  - 2. To protect new and pre-existing adjacent construction from exposure to physical damage, dust, dirt, and water.
  - 3. To provide security of valuable property.
  - 4. To protect trees and plants.

1.2 RELATED SECTIONS

- A. Section 01 54 00 - Construction Aids

PART 2 - PRODUCTS

2.1 GENERAL FABRICATION

- A. Substantial Construction: Barriers and enclosures shall be of adequately substantial construction to serve their purpose without failure throughout the duration of their use. Materials may be new or used, suitable for the intended purpose, but shall not violate requirements of applicable codes and standards.
- B. Rigid Fencing: The general public, as well as adjacent lawns and plantings, shall be protected from harm by the installation of continuous, durable, rigid fencing at the limit lines of each construction area.
- C. Tree Protection: Existing trees that are adjacent to a construction site shall be protected from damage by the installation of durable, rigid 6 foot high fencing at the drip line of each tree.
- D. Dust enclosures.

PART 3 - EXECUTION

3.1 BASIC REQUIREMENTS

- A. Install facilities of a neat and reasonable uniform appearance, structurally adequate for required purposes.
- B. Install barriers and enclosures so as to not create new hazards such as tripping or protrusions that might be a source of safety concern to pedestrians or passers by.
- C. Establish reasonable alternative access when necessary due to placement of barriers.



- D. Maintain barriers during entire construction period.
- E. Relocate barriers as required by progress of construction.

### 3.2 TREE AND PLANT PROTECTION REQUIREMENTS

- A. Preserve and protect existing trees and plants at site which are designed to remain, and those adjacent to site.
- B. Consult with the Owner for removal of agreed-on roots and branches which interfere with construction.
  - 1. Employ a qualified tree surgeon to remove, and to treat cuts.
- C. Provide temporary barriers to a height of six feet, around each, or around each group, of trees and plants. The barriers shall be placed at the drip line of each tree.
- D. Protect root zones of trees and plants:
  - 1. Do not allow vehicular traffic or parking.
  - 2. Do not store materials or products.
  - 3. Prevent dumping of refuse or chemically injurious materials or liquids.
  - 4. Prevent puddling or continuous running water.
- E. Carefully supervise excavating, grading and filling, and subsequent construction operations, to prevent damage.
- F. Replace, or suitably repair, trees and plants designated to remain which are damaged or destroyed due to construction operations. Any damage and any necessary replacements will be evaluated by F&S horticulturists.

### 3.3 DUST ENCLOSURES

- A. Dust enclosures shall be continuous barriers with a rigid frame, made of clean materials, which will prevent dust from leaving work areas. Additionally, they may be required to resist noise and fumes as necessitated by contractors work plan.

### 3.4 REMOVAL

- A. Completely remove barricades, including foundations, when construction has progressed to the point that they are no longer needed, and when approved by the Architect.
- B. Clean and repair damage caused by installation, fill and grade areas of the site to required elevations and slopes, and clean the area.

END OF SECTION 01 56 00

DIVISION 1 - GENERAL REQUIREMENTS  
Section 01 62 04 – Substitution Procedures

1. GENERAL

1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for substitutions.

1.2 SUBSTITUTIONS

A. Base Bid shall be in accordance with the Contract Documents.

B. Substitution requests prior to bidding shall be submitted to Architect, in writing, a minimum of ten (10) days prior to bid date.

C. After the end of the bidding period, substitution requests will be considered only in case of:

1. Product unavailability
2. Other conditions beyond the control of the Contractor

D. Substitution Requests: Submit PDF electronic file of each request submitted for consideration. Identify product or fabrication or installation method to be replaced. Submit requests for substitutions on attached form. Submit a separate request form for each substitution. Include Specification Section number, title, and Drawing numbers and titles. Support each request with the following information:

1. Complete data substantiating compliance of proposed substitution with requirements stated in Contract Documents:
  - a. Product identification, including manufacturer's name and address.
  - b. Manufacturer's literature, identifying:
    - 1) Product description
    - 2) Reference standards
    - 3) Performance and test data
2. Itemized comparison of the proposed substitution with product specified, listing significant variations.
3. Data relating to changes in construction schedule.
4. Effects of substitution on separate contracts.
5. List of changes required in other work or products.
6. Accurate cost data comparing proposed substitution with product specified.
  - a. Amount of net change to Contract Sum
7. Designation of required license fees or royalties.
8. Designation of availability of maintenance services sources replacement materials.

E. Substitutions will not be considered for acceptance when:

1. A substitution is indicated or implied on shop drawings or product data submittals without a formal request from the Contractor.
2. Acceptance will require substantial revision of Contract Documents.
3. In judgment of the Architect, the substitution request does not include adequate information necessary for a complete evaluation.
4. Requested directly by a Subcontractor or supplier.

- F. Substitutions for Convenience: Not allowed
- G. Do not order or install substitute products without recommendation of the Architect and acceptance by the Owner/Using Agency.
- H. Architect will determine acceptability of proposed substitutions.
- I. No verbal or written approvals other than by Change Order will be valid.

1.3 CONTRACTOR'S REPRESENTATION

- A. In making formal request for substitution the Contractor represents that:
  - 1. The proposed product has been investigated and it has been determined that it is equivalent, or superior, in all respects to the product specified.
  - 2. The same warranties or bonds will be provided for the substitute product as for the product specified.
  - 3. Coordination and installation of the accepted substitution into the Work will be accomplished and changes as may be required for the Work to be complete will be accomplished.
  - 4. Claims for additional costs caused by substitution which may subsequently become apparent will be waived by the Contractor.
  - 5. Complete cost data is attached and includes related costs under the Contract, but not:
    - a. Costs under separate contracts.
    - b. Architect's costs for redesign or revision of Contact Documents.

1.4 REQUEST FOR SUBSTITUTION FORM

- A. 01 62 04.1 – Substitution Request Form
- B. Substitutions will be considered only when the substitution form is completed and included with the request for substitution submittal and back-up data.

2. PRODUCTS

(NOT APPLICABLE)

3. EXECUTION

(NOT APPLICABLE)

END OF SECTION 01 62 04

DIVISION 1 - GENERAL REQUIREMENTS  
Section 01 62 04.1 – Request for Substitution Form

REQUEST FOR SUBSTITUTION FORM

Note: Use separate form for each material, product, or equipment item.

Date: \_\_\_\_\_ Request No.: \_\_\_\_\_

Project: \_\_\_\_\_

Location: \_\_\_\_\_

Name of material, product, or equipment item submitted as substitution:

\_\_\_\_\_

Name of material, product, or equipment item specified:

\_\_\_\_\_

Specification Section \_\_\_\_\_, Article \_\_\_\_\_, Paragraph \_\_\_\_\_

Qualities that differ from specified product or system: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Name of Manufacturer/(Fabricator):

\_\_\_\_\_

Address

\_\_\_\_\_

City, State, and Zip

( \_\_\_\_\_ ) \_\_\_\_\_

Telephone

\_\_\_\_\_

Name of Vendor/Supplier

Address

City, State, and Zip

( \_\_\_\_\_ )  
Telephone

Reason for requesting substitution: \_\_\_\_\_

Substitution affects other materials or systems, such as dimensional revisions, redesign of structure, or modifications to other work:

\_\_\_\_\_ No

\_\_\_\_\_ Yes; describe requirements:

If substitution requires modifications to dimensions indicated on drawings, are such modifications clearly indicated on attached data?

\_\_\_\_\_ Yes

\_\_\_\_\_ No; if no, explain: \_\_\_\_\_

Substitution has an effect on construction schedule:

\_\_\_\_\_ No

\_\_\_\_\_ Yes; describe effect on schedule:

Savings or credit to Contract Amount for accepting substitute:

\_\_\_\_\_ Dollars (\$ \_\_\_\_\_)  
Written Amount Amount in Figures

The attached data is furnished herewith for evaluation of the substitution:

Product Data \_\_\_\_\_, Drawings \_\_\_\_\_, Samples \_\_\_\_\_, Tests \_\_\_\_\_, Reports \_\_\_\_\_

Other Information \_\_\_\_\_

The undersigned hereby certifies:

1. The proposed substitution has been fully investigated and is equal or superior to specified product.
2. The same or better warranty will be furnished for proposed substitution as for specified material, product or equipment.
3. All changes in the work resulting from the use of this substitution, if approved, will be coordinated and completed in all respects and all costs, including, but not limited to, those for additional services rendered by the Architect are the responsibility of this Contractor at no additional cost to the Contract.

\_\_\_\_\_  
Contractor

\_\_\_\_\_  
Signed by

\_\_\_\_\_  
Address

\_\_\_\_\_  
City, State, and Zip

**For Use by Architect:**

- Recommend
- Not Recommended
- Insufficient Data
- Recommend as Noted
- Received Too Late

**For Use by Owner:**

- Approved
- Not Approved
- Approved as Noted

By: \_\_\_\_\_

By: \_\_\_\_\_

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

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

END OF FORM

DIVISION 1 - GENERAL REQUIREMENTS  
Section - 01 66 00 - Storage & Protection

1. GENERAL

A. REQUIREMENTS INCLUDE

1. General Contractor make arrangements with Owner for storage of materials and equipment to be installed in project. Protection and security for stored materials and equipment, on and off site is solely contractor's responsibility.

B. OFF-SITE AUTHORIZATION. Payment for materials/equipment stored off-site will be permitted only on prior written authorization, proof of insurance is submitted, and the material is stored in an independent warehouse under the owner's name and paid for by the contractor.

C. SUBMITTALS.

1. In accordance with Section 01 33 23, submit:
  - a. Request for allocation of storage space.
  - b. List of materials and equipment to be stored.
  - c. Proposed location for storage.
  - d. Special storage requirements.
  - e. Schedule of anticipated storage dates.

2. PRODUCTS

A. PROTECTIVE MATERIALS

1. For duration of storage period, provide materials which will provide proper protection against the elements or other harmful environmental conditions.

3. EXECUTION

A. LOCATION

1. Where authorized by Owner.
2. Contractor will resolve conflicts in storage requirements of all subcontractors.

B. PROTECTION

1. Appropriate protection is required as necessary to maintain quality and intent of stored materials.

END OF SECTION 01 66 00

DIVISION 1 - GENERAL REQUIREMENTS  
Section - 01 73 29 - Cutting & Patching

1. GENERAL

1.1 REQUIREMENTS INCLUDE

- A. Unless noted otherwise, each contractor shall:
1. Execute cutting (including excavating), filling or patching of work to:
    - a. Install specified work.
    - b. Remove samples of installed work specified for testing.
    - c. Remove and replace defective work.
  2. In addition, upon written instructions of Architect/Engineer:
    - a. Uncover work to provide for observation of covered work.
    - b. Remove samples of installed materials for testing.
    - c. Remove work to provide for alteration of existing work.
  3. Do not cut or alter work of another contractor without written consent of Architect/Engineer.

1.2 SUBMITTALS

- A. Prior to cutting which affects structural members or work of another contractor, submit written notice to Architect/Engineer requesting consent to proceed with cutting, including:
1. Project identification.
  2. Description of affected work.
  3. Necessity for cutting.
  4. Effect on other work, on structural integrity of project.
  5. Description of proposed work. Designate:
    - a. Scope of cutting and patching.
    - b. Contractor and Crafts to execute the work.
    - c. Products proposed to be used.
    - d. Extent of refinishing.
  6. Alternatives to cutting and patching.
  7. Designation of party responsible for cost of cutting and patching.
- B. Prior to cutting and patching done on instruction of Architect/ Engineer, submit cost estimate.
- C. When conditions of work, or schedule, indicate change of materials or methods, submit recommendation to Architect/Engineer, including:
1. Condition indicating change.
  2. Recommendation for alternative materials or methods.
  3. Submittals specified for substitutions.
- D. Submit written notice to Architect/Engineer, designating time work will be uncovered, to provide for observation.



1.3 PAYMENT FOR COSTS

- A. Costs caused by ill-timed or defective work, or work not conforming to contract documents, including costs for additional services of Architect/Engineer: Party responsible for ill-timed, rejected or non-conforming work.
- B. Work done on instructions of Architect/Engineer (by change order only), other than defective or non-conforming work: Owner

2. PRODUCTS

- 2.1 MATERIALS. For replacement of work removed: Comply with specifications for type of work to be performed.

3. EXECUTION

3.1 INSPECTION

- A. Inspect existing conditions of work, including elements subject to movement or damage during:
  - 1. Cutting and patching.
  - 2. Excavating and backfilling.
- B. After uncovering work, inspect conditions affecting installation of new products.

3.2 PREPARATION

- A. Prior to cutting:
  - 1. Provide shoring, bracing and support to maintain structural integrity of project.
  - 2. Provide protection for other portions of the project.
  - 3. Provide protection from elements.

3.3 PERFORMANCE

- A. Execute fitting and adjustment of products to provide finished installation to comply with specified tolerances, finishes.
- B. Execute cutting and demolition by methods which will prevent damage to other work, and will provide proper surfaces to receive installation of repairs and new work.
- C. Restore work which has been cut or removed; install new products to provide completed work in accord with contract documents.
- D. Refinish entire surfaces to provide an even finish.
- E. Continuous surfaces: To nearest intersection(s).
- F. Assembly: Entire refinishing.

END OF SECTION 01 73 29

DIVISION 1 - GENERAL REQUIREMENTS  
Section - 01 74 13 - Construction Cleaning

1. GENERAL

1.1 REQUIREMENTS INCLUDE

A. General Contractor: Supervise and coordinate cleaning operations.

1.2 RELATED REQUIREMENTS

A. Specified elsewhere:

1. Individual Specification Sections: specific cleaning for product or work.
2. Section 01 35 16 – Remodeling Project Procedures

2. PRODUCTS

2.1 EQUIPMENT

A. As designated in individual specification sections.

3. EXECUTION

3.1 CLEANING

A. As designated in individual specification sections.

3.2 DISPOSAL

- A. Maintain individual disposal units for sorting of debris for recycling and general disposal.
- B. Properly dispose of all contents of dumpsters off site in an environmentally friendly manner and in compliance with local, state and federal regulations.
- C. No burning of debris or materials is acceptable on site.
- D. All hazardous materials shall be disposed of off-site in an EPA approved facility.

END OF SECTION 01 74 13

DIVISION 1 - GENERAL REQUIREMENTS  
Section - 01 74 23 - Final Cleaning

1. GENERAL

1.1 REQUIREMENTS INCLUDE

A. General Contractor: Provide final cleaning:

1. At completion of work, or at such other times as directed by the Contractor, remove all waste, debris, rubbish, tools, equipment, machinery and surplus materials. Clean all sight exposed surfaces; leave work clean and ready for occupancy.

1.1 RELATED REQUIREMENTS

A. Specified elsewhere:

1. Section 01 74 13 - Construction Cleaning.

2. PRODUCTS

- 2.1 All products shall be environmentally friendly "Green" cleaning products.

3. EXECUTION

3.1 FINAL CLEANING

A. Employ experienced workmen for final cleaning.

B. Remove grease, dust, dirt, stains, labels, fingerprints, protection and other foreign materials from sight-exposed finished surfaces; polish surfaces so designated to specified finish.

1. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed surfaces, and of concealed spaces to ensure performance.

C. Repair, patch and touch up marred surfaces to specified finish, to match adjacent surfaces.

D. Contractor soft broom clean all exposed concrete surfaces clean; other paved areas with soft or stiff broom as directed. Rake clean other surfaces on grounds.

E. Contractor to replace air handling filters if units were not protected during construction and shown to have construction dust/debris.

F. Contractor maintain finally cleaned areas until project, or designated portion thereof, is accepted by A/E.

END OF SECTION 01 74 23

DIVISION 1 - GENERAL REQUIREMENTS  
Section - 01 78 36 - Warranties & Bonds

1. GENERAL
  - 1.1 REQUIREMENTS INCLUDE
    - A. Each Contractor shall warrant their work in accordance with the Standard Documents for Construction. In addition, the following Warranties and Bonds shall be provided as specified.
    - B. Champaign County will be the designated agent during the warranty period.
2. PRODUCTS
  - A. Warranties and Bonds. Include the following:
    1. Warranty and/or bond.
    2. List of circumstances and conditions that would affect validity of warranty or bond.
3. EXECUTION (NOT APPLICABLE)

END OF SECTION 01 78 36

DIVISION 02 - EXISTING CONDITIONS  
Section 02 41 19 - Selective Demolition

PART 1 - GENERAL

1.1 WORK INCLUDES

- A. Contractor shall provide all labor, materials, equipment and supplies necessary.
  - 1. Demolition and removal of selected portions of building as noted on the drawings and as required to complete the work shown on the drawings.

1.2 RELATED SECTIONS

- A. Drawings.
- B. General provisions of the contract including General and Supplemental Conditions.
- C. Division 01 Specifications.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and returned to owner or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Using Agency/University cleaned and ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, clean and prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property for dust control and for noise control. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
  - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's on-site operations are uninterrupted.
  - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
  - 3. Coordination for shutoff, capping, and continuation of utility services.
  - 4. Coordination on the use of elevator and stairs.

5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- C. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- D. Pre-demolition Photographs or Video: Submit before Work begins.
  1. Any damage not documented as pre-existing will be repaired by contractor.
- E. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.
- F. Closeout Submittals
  1. Inventory: Submit a list of items that have been removed and salvaged

#### 1.5 QUALITY ASSURANCE

- A. Pre-demolition Conference: Conduct conference at Project site.
  1. Inspect and discuss condition of construction to be selectively demolished.
  2. Review structural load limitations of existing structure.
  3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
  5. Review areas where existing construction is to remain and requires protection.

#### 1.6 PROJECT CONDITIONS

- A. Owner will occupy portions of building to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
- F. Warranty: Existing Warranties. Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding.
- G. If any suspected hazardous materials are encountered do not disturb; immediately notify Architect and Owner.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.
- C. Call the Fire Department and notify the Owner if the following systems will be disabled/ restricted at any time during construction/ renovation.
  - 1. Fire Alarm.
  - 2. Fire Suppression.
  - 3. Emergency exit and evacuation.
- D. Any construction/renovation that creates excessive dust (i.e. demolition of plaster, drywall, or flooring) must use dust barriers and negative pressure ventilation.
- E. Any construction/renovation that involves temporary loss of power or ventilation must be coordinated/scheduled with the Facility Manager and will be discussed and determined at the pre-construction meeting.
- F. Any construction/ renovation that creates excessive noise (i.e. jack hammering, use of power saws, power drills,) must be coordinated/ scheduled with the Facility Manager or Using Agency, which will be determined at the pre-construction meeting.
- G. Any construction/ renovation that breaches/ penetrates the building envelope (roof, window, and wall) must be protected from water damage and subsequent mold growth.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. Owner and Architect do not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

- E. Verify hazardous materials have been remediated prior to proceeding with building demolition operations.

### 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL/PLUMBING SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
  - 1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary."

### 3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."
- B. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  - 2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  - 3. Cover and protect furniture, furnishings, and equipment that have not been removed.
  - 4. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
  - 1. Strengthen or add new supports when required during progress of selective demolition.
- D. Remove temporary barricades and protections where/when hazards no longer exist.

### 3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
  - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden



space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations and for two (2) hours after operations cease.

4. Maintain adequate ventilation when using cutting torches.
  5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  6. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  7. Dispose of demolished items and materials promptly.
- B. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
  2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  3. Protect items from damage during transport and storage.
  4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- C. Unless otherwise indicated, demolition waste becomes the property of the Contractor.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

### 3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, returned to Owner, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site.
1. Do not allow demolished materials to accumulate on-site.
  2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

### 3.6 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 41 19

DIVISION 06 - WOOD, PLASTICS, & COMPOSITES  
Section 06 10 00 - Rough Carpentry

PART 1 - GENERAL

1.1. WORK INCLUDES

- A. Coordinating Contractor shall provide all labor, materials, equipment and supplies for:
  - 1. Carpentry work shown on the drawings for blocking.

1.2. RELATED WORK

- A. Drawings.
- B. General provisions of the contract including General and Supplemental Conditions.
- C. Division 01 Specifications.

1.3. REFERENCES

- A. All references are the current editions unless noted otherwise.
- B. ALSC - American Lumber Standards Committee: Softwood Lumber Standards.
- C. APA - American Plywood Association: Grades and Standards.
- D. AWPA - American Wood Preservers' Association
- E. FS TT-W-571 - Wood Preservation: Treating Practices.
- F. NFPA - National Forest Products Association.
- G. SFPA - Southern Forest Products Association.
- H. WCLIB - West Coast Lumber Inspection Bureau: Standard Grading Rules for West Coast Lumber.
- I. WWPA - Western Wood Products Association.

1.4. QUALITY ASSURANCE

- A. Plywood Standard: Comply with DOC, PS 1.

1.5. PRODUCT HANDLING

- A. Delivery and Storage: Keep materials dry during delivery and storage. Protect against exposure to weather and store above ground on framework or blocking. Cover with protective waterproof covering. Stack plywood to provide air circulation within stacks.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Wood sheathing for roofs shall be 5/8" thickness.
- B. 2 x 2 blocking will be straight and smooth with no knots or blemishes.
- C. Fasteners and Anchorages: Provide size, type, material and finish as recommended by applicable Standards for nails, staples, screws, bolts, nuts, washers and anchoring devices.
- D. Treated wood is not permitted.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. Examine the supporting structure and the conditions under which the carpentry work is to be installed. Notify the Architect in writing of conditions detrimental to the work. Do not proceed with the installation until unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Basic requirements:
  - 1. Discard units of material with defects which might impair the quality of the work, and units which are too small to fabricate the work with minimum joints or the optimum joint arrangement.
  - 2. Set carpentry work accurately to indicated levels and lines, with members plumb and true and accurately cut and fitted.
  - 3. Securely attach carpentry work by anchoring and fastening as shown or by recognized standards. Countersink nail heads on exposed carpentry work and fill holes. Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials.
  - 4. Make tight connections between members: Install fasteners without splitting of wood; predrill as required.
  - 5. Select fasteners of a size that will make tight all connections between members. Install fasteners without the splitting of wood; pre-drill as required.
- B. Wood blocking:
  - 1. Provide wherever shown and where required for screeding or attachment of other work or equipment / items requiring blocking. Form to shapes as shown and cut for true line and level of work to be attached. Coordinate location with other work involved.
  - 2. Attachment shall support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown.
- C. Installation of plywood:
  - 1. Comply with recommendations of the American Plywood Association (APA) for the installation of plywood.

END OF SECTION 06 10 00

DIVISION 7 - THERMAL AND MOISTURE PROTECTION  
SECTION 07 31 13 - ASPHALT SHINGLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Glass-fiber-reinforced asphalt shingles.
  - 2. Underlayment materials.
- B. Related Requirements:
  - 1. Section 07 62 00 – Flashing and Sheet Metal

1.3 DEFINITIONS

- A. Roofing Terminology: See ASTM D1079 for definitions of terms related to roofing Work in this Section.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:
  - 1. Contractor shall arrange conference at project site. Contractor, installation contractor project manager and site foreman, and Architect shall be in attendance.

1.5 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Asphalt shingles.
  - 2. Underlayment materials.
  - 3. Asphalt roofing cement.
  - 4. Elastomeric flashing sealant.
- B. Samples: For each exposed product and for each color and blend specified, in sizes indicated.
  - 1. Asphalt Shingles: Full size.
  - 2. Ridge and Hip Cap Shingles: Full size.

C. Samples for Verification: For the following products, in sizes indicated:

1. Asphalt Shingles: Full size for each type of shingle specified.
2. Ridge and Hip Cap Shingles: Full size.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each type of asphalt shingle and underlayment product indicated, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Research Reports: For synthetic underlayment, from ICC-ES, indicating that product is suitable for intended use under applicable building codes.
- D. Sample Warranty: For manufacturer's materials warranty.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For asphalt shingles to include in maintenance manuals.
- B. Materials warranties.
- C. Roofing Installer's warranty.

#### 1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Asphalt Shingles: 100 sq. ft. (9.3 sq. m) of each type and in each color and blend, in unbroken bundles.

#### 1.9 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized installer who is trained and approved by manufacturer.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated location protected from weather, sunlight, and moisture in accordance with manufacturer's written instructions.
- B. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double-stack rolls.
- C. Protect unused roofing materials from weather, sunlight, and moisture when left overnight or when roofing Work is not in progress.

- D. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

#### 1.11 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with installation only when existing and forecasted weather conditions permit product installation and related Work to be performed in accordance with manufacturer's written instructions and warranty requirements.
  - 1. Install self-adhering, polymer-modified bitumen sheet underlayment within the range of ambient and substrate temperatures recommended in writing by manufacturer.

#### 1.12 WARRANTY

- A. Materials Warranty: Manufacturer agrees to repair or replace asphalt shingles that fail within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Manufacturing defects.
  - 2. Materials Warranty Period: 25 years from date of Substantial Completion, prorated, with first three years non-prorated.
  - 3. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds of up to 130 mph (58 m/s) for fifteen (15) years from date of Substantial Completion.
  - 4. Workmanship Warranty Period: Two years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 SOURCE LIMITATIONS

- A. Obtain each type of product from single source from single manufacturer.

#### 2.2 PERFORMANCE REQUIREMENTS

- A. Exterior Fire-Test Exposure: Provide asphalt shingles and related roofing materials identical to those of assemblies tested for Class A fire resistance in accordance with ASTM E108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
- B. Wind Resistance: Provide asphalt shingles that comply with requirements of ASTM D3161/D3161M, Class F, and with ASTM D7158/D7158M, Class H.

## 2.3 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Laminated-Strip Asphalt Shingles: ASTM D3462/D3462M, laminated, multi-ply overlay construction; glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
  - 1. GAF "Timberline Ultra, Heather Blend"
  - 2. Substitutions in accordance with 01 62 04 - Substitutions
  - 3. Algae Resistance: Granules resist algae discoloration.
  - 4. Color and Blends: Match Architect's samples.
- B. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles.

## 2.4 UNDERLAYMENT MATERIALS

- A. Organic Felt: Asphalt-saturated organic felts, nonperforated and complying with the following:
  - 1. ASTM D226/D226M: Type I.
- B. Water Barrier/Ice Dam Membrane:
  - 1. Provide self-adhering, composite rubberized asphalt with polyethylene film water barrier membrane with the following general standards:
    - a. minimum thickness: 40 MILS
    - b. Tensile strength: 250 PSI
    - c. Elongation – ultimate failure of rubberized asphalt: 250%
    - d. Pliability – 180 degree F. bend (1" mandrel at -25 degrees F.): unaffected.
    - e. Adhesion to plywood (lb/inch width): 3.0 minimum.
    - f. Extend water barrier/ice dam membrane so it extends 4'-0" beyond outside face of exterior masonry walls.
  - 2. Provide at roof edge metal flashings tight with fascia boards and ridge, hip, and valley areas as indicated on Drawings. Weather lap joints 2" (50 MM) and seal with plastic cement.

## 2.5 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D4586/D4586M Type II, asbestos free.
- B. Elastomeric Flashing Sealant: ASTM C920, Type S, Grade NS, one-part, non-sag, elastomeric polymer sealant; of class and use classifications required to seal joints and remain watertight; recommended in writing by manufacturer for installation of flashing systems.
- C. Roofing Nails: ASTM F1667, hot-dip galvanized-steel wire shingle nails, 11 gage minimum 0.120-inch- (3-mm-) diameter, sharp-pointed, with a 3/8" diameter flat head and of sufficient length to provide total penetration 3/4 inch (19 mm) into solid wood decking.
  - 1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- D. Underlayment Nails: Aluminum, stainless steel, or hot-dip galvanized-steel wire nails with low-profile metal or plastic caps, 1-inch- (25-mm-) minimum diameter.

1. Provide with minimum 0.0134-inch- (0.34-mm-) thick metal cap, 0.010-inch- (0.25-mm-) thick power-driven metal cap, or 0.035-inch- (0.89-mm-) thick plastic cap; and with minimum 0.083-inch- (2.11-mm-) thick ring shank or 0.091-inch- (2.31-mm-) thick smooth shank of length to penetrate at least 3/4 inch (19 mm) into roof sheathing or to penetrate through roof sheathing less than 3/4 inch (19 mm) thick.

2.6 METAL FLASHING AND TRIM – See Section 07 62 00

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
  2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored and that provisions have been made for flashings and penetrations through asphalt shingles.
  3. Verify that vent stacks and other penetrations through roofing are installed and securely fastened.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove all existing roofing down to the roof deck.
- B. Verify that the deck is dry, sound, clean and smooth. It shall be free of any depressions, waves, and projections.
- C. Cover with sheet metal, all holes over 1 inch (25mm) in diameter, cracks over 1/2 inch (12mm) in width, loose knots and excessively resinous areas.
- D. Clean deck surfaces thoroughly prior to installation of eaves protection membrane and underlayment.

3.3 INSTALLATION OF UNDERLAYMENTS General:

1. Install using methods in accordance with manufacturer's recommendations and local building codes. When local codes and application instructions are in conflict, the more stringent requirements shall take precedence.
- B. Eaves (Original Building):



1. install ice/water shield up the slope from eaves edge a full 36 inches (914mm) or to at least 24 inches (610 mm) beyond the interior "warm wall" (whichever length is greatest). Lap ends 6 inches (152mm) and bond.

C. Valleys:

1. Install eaves protection membrane at least 36 (914mm) inches wide and centered on the valley. Lap ends 6 inches (152mm) and seal.
2. Install metal flashing over ice/water shield before roof deck protection is installed; DO NOT nail through the flashing. Secure the flashing by nailing at 18 inches (457 mm) on center just beyond edge of flashing so that nail heads hold down the edge.

D. Hips and Ridges:

1. Install ice/water barrier along entire lengths.

E. Roof Deck Protection:

1. Install one layer of roofing felt over the entire area not protected by ice/water shield at the eaves or valley. Install sheets horizontally so water sheds and nail in place.
2. On roofs sloped at more than 4:12, lap horizontal edges at least 2 inches (51mm) and at least 2 inches (51mm) over eaves protection membrane.
3. Lap ends at least 4 inches (102 mm). Stagger end laps of each layer at least 36 inches (914 mm).
4. Lap roofing felt over ice/water shield in valley at least 6 inches (152mm).

F. Penetrations:

1. Vent pipes: Install a 24 inch (610 mm) square piece of eaves protection membrane lapping over roof deck underlayment; seal tightly to pipe.
2. Vertical walls: Install eaves protection membrane extending at least 6 inches (152mm) up the wall and 12 inches (305mm) on to the roof surface. Lap the membrane over the roof deck underlayment.
3. Chimneys: Install eaves protection membrane around entire chimney extending at least 6 inches (152mm) up the wall and 12 inches (305mm) on to the roof surface. Lap the membrane over the roof deck underlayment.
4. Rake Edges: Install metal edge flashing over eaves protection membrane and roof deck underlayment; set tight to rake boards; lap joints at least 2 inches (51mm) and seal with plastic cement; secure with nails.

### 3.4 INSTALLATION OF STARTER SHINGLES

A. General:

1. Install in accordance with manufacturer's instructions and local building codes. When local codes and application instructions are in conflict, the more stringent requirements shall take precedence.
2. Refer to application instructions for the selected starter strip shingles.

B. Placement and Nailing:

1. For maximum wind resistance along rakes & eaves, install any starter strip containing sealant or cement shingles to underlayment and each other in a 4" (102mm) width of asphalt plastic roof cement.
2. Place starter strip shingles 1/4" – 3/4" (6 – 19mm) over eave and rake edges to provide drip edge.
3. Nail approximately 1-1/2" – 3" (38 – 76mm) above the butt edge of the shingle.
4. Rake starter course should overlap eave edge starter strip at least 3" (76mm).

### 3.5 INSTALLATION OF SHINGLES

#### A. General:

1. Install in accordance with manufacturer's instructions and local building codes. When local codes and application instructions are in conflict, the more stringent requirements shall take precedence.
2. Minimize breakage of shingles by avoiding dropping bundles on edge, by separating shingles carefully (not by "breaking" over ridge or bundles), and by taking extra precautions in temperatures below 40 degrees F (4 degrees C).
3. Handle carefully in hot weather to avoid scuffing the surfacing or damaging the shingle edges.

#### B. Placement and Nailing: Secure with 4, 5, or 6 nails per shingle per manufacturer's application instructions or local codes

2. Placement of nails varies based on the type of shingle specified. Consult the application instructions for the specified shingle for details.
3. Nails must be driven flush with the shingle surface. Do not overdrive or under drive the nails.
4. Shingle offset varies based on the type of shingle specified. Consult the application instructions for the specified shingle for details.

#### C. Valleys Install valleys using the "open valley" method:

- a. Snap diverging chalk lines on the metal flashing, starting at 3 inches (76mm) each side of top of valley, spreading at 1/8 inch per foot (9mm per meter) to the eaves.
- b. Run shingles to chalk line.
- c. Trim last shingle in each course to match the chalk line; do not trim shingles to less than 12 inches (305mm) wide.
- d. Apply a 2 inch (51mm) wide strip of plastic cement under ends of shingles, sealing them to the metal flashing.

#### D. Penetrations

1. All Penetrations are to be flashed according to manufacturer, ARMA and NRCA application instructions and construction details.

### 3.6 INSTALLATION OF METAL FLASHING AND TRIM

- #### A. Install metal flashings and trim to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

3.7 PROTECTION

- A. Protect installed products from foot traffic until completion of the project.
- B. Any roof areas that are not completed by the end of the workday are to be protected from moisture and contaminants.

END OF SECTION 07 31 13

DIVISION 7 - THERMAL & MOISTURE PROTECTION  
Section 07 62 00 - Flashing and Sheet Metal

PART 1 - GENERAL

1.1 WORK INCLUDES:

- A. Base Bid:
  - 1. General Contractor shall provide all labor and materials for:
    - a. Flashing and sheet metal as indicated on Drawings and specified herein at the Courthouse Addition.
    - b. Replacement of damaged copper flashings, sheet metal as indicated on Drawings and specified herein at the Courthouse original building (20 oz. copper)

1.2 RELATED WORK:

- A. Specified elsewhere:
  - 1. Section 07 31 13 – Asphalt Shingles

1.3 QUALITY ASSURANCE

- A. Use skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. In addition to complying with pertinent codes and regulations, comply with pertinent recommendations contained in the current edition of "Architectural Sheet Metal Manual" published by the Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
- C. Copper Development Association Inc.:
  - 1. CDA - Copper in Architecture - Handbook.
- D. Standard commercial items may be used for flashing, trim, reglets, and similar purposes provided such items meet or exceed the quality standards specified.

1.4 SUBMITTALS

- A. Submit:
  - 2. Product data:
    - a. Materials list of items proposed to be provided under this Section
    - b. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
    - c. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the work.
  - 3. Shop drawings:
    - a. In sufficient detail to show fabrication, installation, anchorage, and interface of the work of this section with the work of adjacent trades.

1.5 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 10 years from date of substantial completion

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Sheet Metal Standard for Copper: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- D. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested in accordance with ANSI/SPRI/FM 4435/ES-1.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change: 120 deg F ambient;

### 2.1 SHEET METALS

- A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hussey Copper Ltd.
    - b. Revere Copper Products, Inc.

2. Nonpatinated, Exposed Finish: Mill.
- 3.

## 2.2 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- B. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F ; and complying with physical requirements of ASTM D226/D226M for Type I and Type II felts.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Atlas Molded Products; a Division of Atlas Roofing Corporation.
  2. Intertape Polymer Group.
  3. Kirsch Building Products, LLC.
  4. SDP Advanced Polymer Products Inc.
- D. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Carlisle WIP Products; a brand of Carlisle Construction Materials.
    - b. GCP Applied Technologies Inc.
    - c. Henry Company.
    - d. Metal-Fab Manufacturing, a Drexel Metals Company.
    - e. Owens Corning.
    - f. Polyglass U.S.A., Inc.
    - g. Protecto Wrap Company.
    - h. SDP Advanced Polymer Products Inc.
  2. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F (29 deg C) or lower.
- E. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum.

## 2.3 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
  2. Fasteners for Copper Sheet: Copper, hardware bronze or passivated Series 300 stainless steel.
- C. Solder:
1. For Copper: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead with maximum lead content of 0.2 percent.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- E. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
1. Copper compatible elastomeric polyurethane sealant as tested by sealant manufacturer for copper substrates.
- F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.
- H. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

## 2.4 FABRICATION, GENERAL

- A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
  2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
  3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
  4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
  5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances:
1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
  2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
  2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- G. Seams:
1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
  2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

## 2.5 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Copings: Fabricate in minimum 96-inch long, but not exceeding 12-foot long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, solder or weld watertight. Shop fabricate interior and exterior corners.
1. Fabricate from the following materials:
    - a. Aluminum: .040" thick.
- B. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- C. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

## 2.6 SHEET METAL FABRICATIONS (ADDITION)

- A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:
1. Aluminum: .032" thick
- B. Valley Flashing: Fabricate from the following materials:
1. Aluminum: .032" thick
- C. Drip Edges: Fabricate from the following materials:
1. Aluminum: .032" thick



D. Eave, Rake, Ridge Flashing: Fabricate from the following materials:

1. Aluminum: .032" thick

## 2.7 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12-foot-long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch- high, end dams. Fabricate from the following materials:

1. Copper: 16 oz./sq. ft. (0.55 mm thick)

B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch- high, end dams. Fabricate from the following materials:

1. Copper: 16 oz./sq. ft. (0.55 mm thick)

C. Wall Expansion-Joint Cover: Fabricate fe following materials:

1. Copper: 16 oz./sq. ft. (0.55 mm thick)

## 2.8 OTHER MATERIALS

A. Provide separation of dissimilar materials to prevent galvanic action.

B. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the contractor subject to the approval of the Architect.

## PART 3 - EXECUTION

### 3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

### 3.2 WORKMANSHIP

A. General:

1. Form sheet metal accurately and to the dimensions and shapes required, finishing molded and broken surfaces with true, sharp, and straight lines and angles and, where intercepting other members, coping to an accurate fit and soldering securely.
2. Unless otherwise specifically permitted by the Architect, turn exposed edges back 1/2 inch.

B. Form, fabricate, and install sheet metal so as to adequately provide for expansion and contraction in the finished work.

C. Weatherproofing:

1. Finish watertight and weather tight where so required.

2. Make lock seam work flat and true to line.
  3. Where lap seams are not soldered, lap according to pitch, in no case less than three (3) inches.
  4. Make flat and lap seams in the direction of flow.
- D. Joints:
1. Join parts with stainless steel sheet metal screws where necessary for strength and stiffness.
- E. Nailing:
1. Whenever possible, secure metal by means of clips or cleats, without nailing through the exterior metal.
  2. In general, space nails, rivets, and screws not more than eight (8) inches apart and, where exposed to the weather, use stainless steel or neoprene washers.
  3. For nailing into concrete, use drilled plugholes and plugs.
- F. Separate dissimilar metals from each other by painting each metal surface in area of contact with a heavy application of bituminous coating, or by other permanent separation as recommended by manufacturers of dissimilar metals.
- G. Installation of Aluminum Items:
1. Where aluminum flashing is shown with contact to non-ferrous or ferrous metal, wood or cementitious materials, apply 15-mil bituminous coating or heavy trowel coating of roofing cement on substrate or as back-coating on flashing.
  2. Provide form flat-lock seams with epoxy seam sealer or other permanent sealer recommended by aluminum manufacturer except at expansion joints.
  3. Clean exposed aluminum surfaces of every substance, which is visible or might cause corrosion of metal or deterioration of finish.
- 3.3 EMBEDMENT
- A. Embed metal in connection with roofs in a solid bead of sealant, using materials and methods approved in advance by the Architect/Engineer.
- 3.4 TESTS
- A. Upon request of the Architect/Engineer, demonstrate by hose or standing water that the flashing and sheet metal are completely watertight.

END OF SECTION 07 62 00

ABBREVIATIONS

A		L	LAVATORY
ACT	ACOUSTICAL CEILING TILE	M	
AD	AREA DRAIN	MATL	MATERIAL
AFF	ABOVE FINISHED FLOOR	MAX	MAXIMUM
ALUM	ALUMINUM	MECH	MECHANICAL
ANOD	ANODIZED	MFR	MANUFACTURER
APPROX	APPROXIMATE	MIN	MINIMUM
B		MO	MASONRY OPENING
BSMT	BASEMENT	MRGWB	MOISTURE-RESISTANT GYPSUM WALL BOARD
BTTM	BOTTOM OF	MTD	MOUNTED
C		MTL	METAL
C/C	CENTER TO CENTER	N	
CIP	CAST IN PLACE	NIC	NOT IN CONTRACT
CJ	CONTROL JOINT	NO	NUMBER
CLG	CEILING	NOM	NOMINAL
CLR	CLEAR	O	
CMU	CONCRETE MASONRY UNIT	OC	ON CENTER
CO	CLEAN OUT	OH	OPPOSITE HAND
COL	COLUMN	OZ	OUNCE
CONC	CONCRETE	P	
CONST JT	CONSTRUCTION JOINT	PCC	PRE-CAST CONCRETE
CONT	CONTINUOUS	PLUMB	PLUMBING
CPT	CARPET	PNT	PAINT/PAINITED
CT	CERAMIC TILE	PT	POUNDS PER SQUARE INCH
D		PT	PRESSURE TREATED
DBL	DOUBLE	PVC	POLYVINYL CHLORIDE
DEMO	DEMOLISH	R	
DIA	DIAMETER	R	RADIUS
DIMS	DIMENSIONS	RBR	RUBBER
DN	DOWN	RCP	REFLECTED CEILING PLAN
DTL	DETAIL	RD	ROOF DRAIN
DWG	DRAWING	REINF	REINFORCED
E		REQD	REQUIRED
EA	EACH	RM	ROOM
EJ	EXPANSION JOINT	S	
EL	ELEVATION	SF	SQUARE FOOT
ELEC	ELECTRICAL	SIM	SIMILAR
ELEV	ELEVATOR / ELEVATION	SOG	SLAB ON GRADE
EPDM	ETHYLENE PROPYLENE DIENE ROOFING	SPEC	SPECIFIED OR SPECIFICATION
EQ	EQUAL	SPK	SPRINKLER
EXIST	EXISTING	SQ	SQUARE
EXT	EXTERIOR	SSTL	STAINLESS STEEL
F		STC	SOUND TRANSMISSION COEFFICIENT
FD	FLOOR DRAIN	STL	STEEL
FE	FIRE EXTINGUISHER	STRUCT	STRUCTURAL
FEC	FIRE EXTINGUISHER CABINET	T	
FFE	FINISHED FLOOR ELEVATION	T&G	TONGUE & GROOVE
FIN	FINISH	TI	TOP OF
FLR	FLOOR	T/D	TELEPHONE/DATA
FND	FOUNDATION	TELE	TELEPHONE
FO	FACE OF	TLT	TOILET
FTG	FOOTING	TOC	TOP OF CONCRETE
G		TOS	TOP OF STEEL / STRUCTURE
GA	GAUGE	TOW	TOP OF WALL
GALV	GALVANIZED	TYP	TYPICAL
GWB	GYPSUM WALL BOARD	U	
H		UNO	UNLESS NOTED OTHERWISE
HC	HOLLOW CORE	V	
HM	HOLLOW METAL	VIF	VERIFY IN FIELD
HVAC	HEATING, VENTILATING, AND AIR CONDITIONING	VP	VISION PANEL
I		W	
INSUL	INSULATION / INSULATED	WI	WITH
INT	INTERIOR	WD	WOOD
IRGWB	IMPACT RESISTANT GYPSUM WALLBOARD	WWF	WELDED WIRE FABRIC

# CHAMPAIGN COUNTY COURTHOUSE

101 E MAIN ST  
URBANA, IL 61801

ITB # : 2021-002

BE PROJECT NO : 020156

95% REVIEW

DRAWING MATRIX

Sheet Number	Sheet Name
GENERAL	
G100	COVER SHEET
G110	ARCHITECTURAL SITE PLAN
ARCHITECTURAL	
D100	ORIGINAL ROOF PLAN - EXISTING/DEMO
D101	ADDITION ROOF PLAN - EXISTING/DEMO
A100	ORIGINAL ROOF PLAN - NEW WORK
A101	ADDITION ROOF PLAN - NEW WORK
A902	DETAILS

SCOPE OF WORK

SCOPE OF WORK

APPLICABLE BUILDING CODES

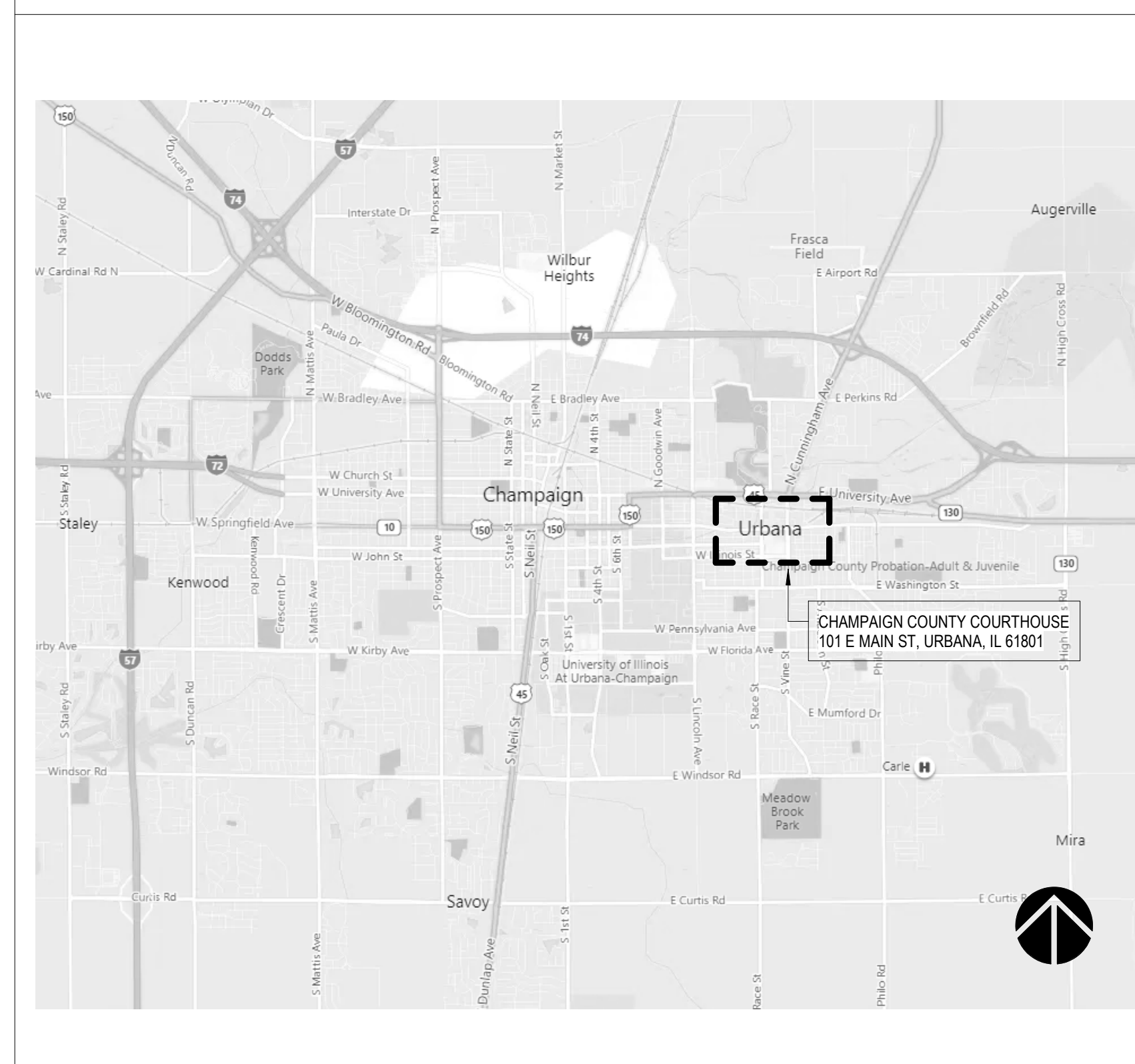
GOVERNING CODES:

- INTERNATIONAL BUILDING CODE 2009
- INTERNATIONAL FIRE CODE 2009
- ILLINOIS STATE PLUMBING CODE
- INTERNATIONAL MECHANICAL CODE 2009
- AMERICAN NATIONAL STANDARD INSTITUTE (ANSI)
- ANSI C2 - NATIONAL ELECTRICAL SAFETY CODE
- AMERICAN STANDARD TESTING MATERIALS (ASTM)
- NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) LIFE SAFETY CODE (LSC) NFPA 101
- NATIONAL FIRE CODE (NFC) 220
- SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION (SMACNA)
- UNDERWRITERS' LABORATORIES, INC. (UL)

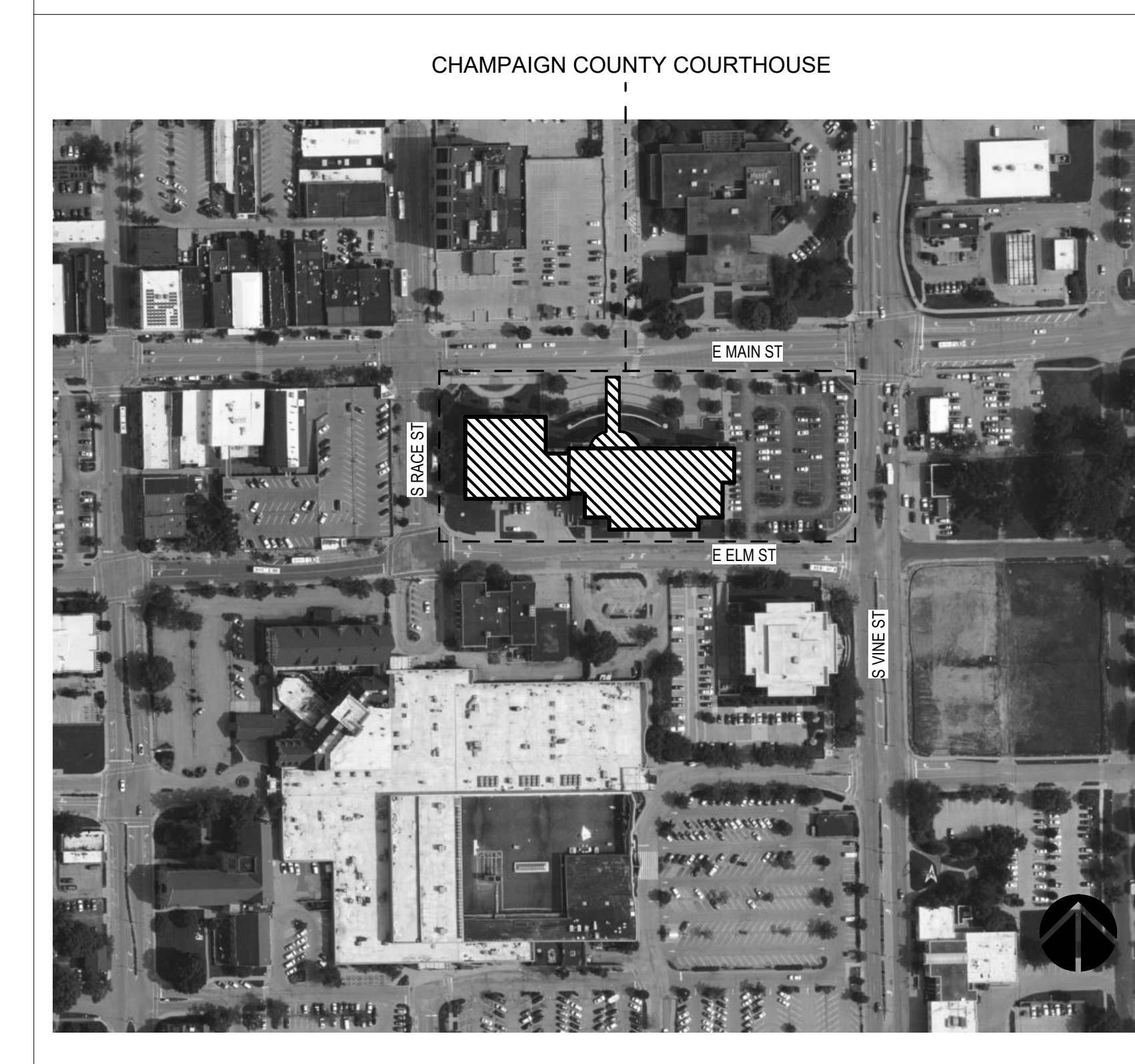
SYMBOLS LEGEND

**DETAIL NUMBER**  
 X  
 XX  
**SHEET NUMBER**  
 X  
 XX  
**ROOM NAME**  
 XX  
**ROOM NUMBER**  
 A-123  
**SQUARE FOOTAGE**  
 XX  
**INTERIOR ELEVATION TAG**  
 X  
 XX  
**NORTH ARROW**  
 NORTH  
**DIMENSION STRING**  
 1"  
**ELEVATION TAG**  
 X  
 XX  
**SECTION TAG**  
 X  
 XX  
**DETAIL TAG**  
 X  
 XX  
**DETAIL TAG**  
 X  
 XX  
**GRID LINE**  
 05  
 B  
**ALIGN/FLUSH SURFACES**  
**DOOR TAG**  
 XX  
**SIGNAGE TAG**  
 X-XX-a  
**ROOM HEIGHT**  
 X'-X"  
**WINDOW TAG**  
 XX  
**WALL TAG**  
 XX  
**EQUIPMENT TAG**  
 XX  
**KEYNOTE**  
 01

SITE LOCATION MAP



SITE MAP



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Issue Date	File
04/30/21	ISSUE FOR BID

CHAMPAIGN COUNTY COURTHOUSE ROOF REPLACEMENT

101 E MAIN ST  
URBANA, IL 61801

COVER SHEET

BE Project No.  
020156

Drawn By:  
JS

Drawing No.  
G100



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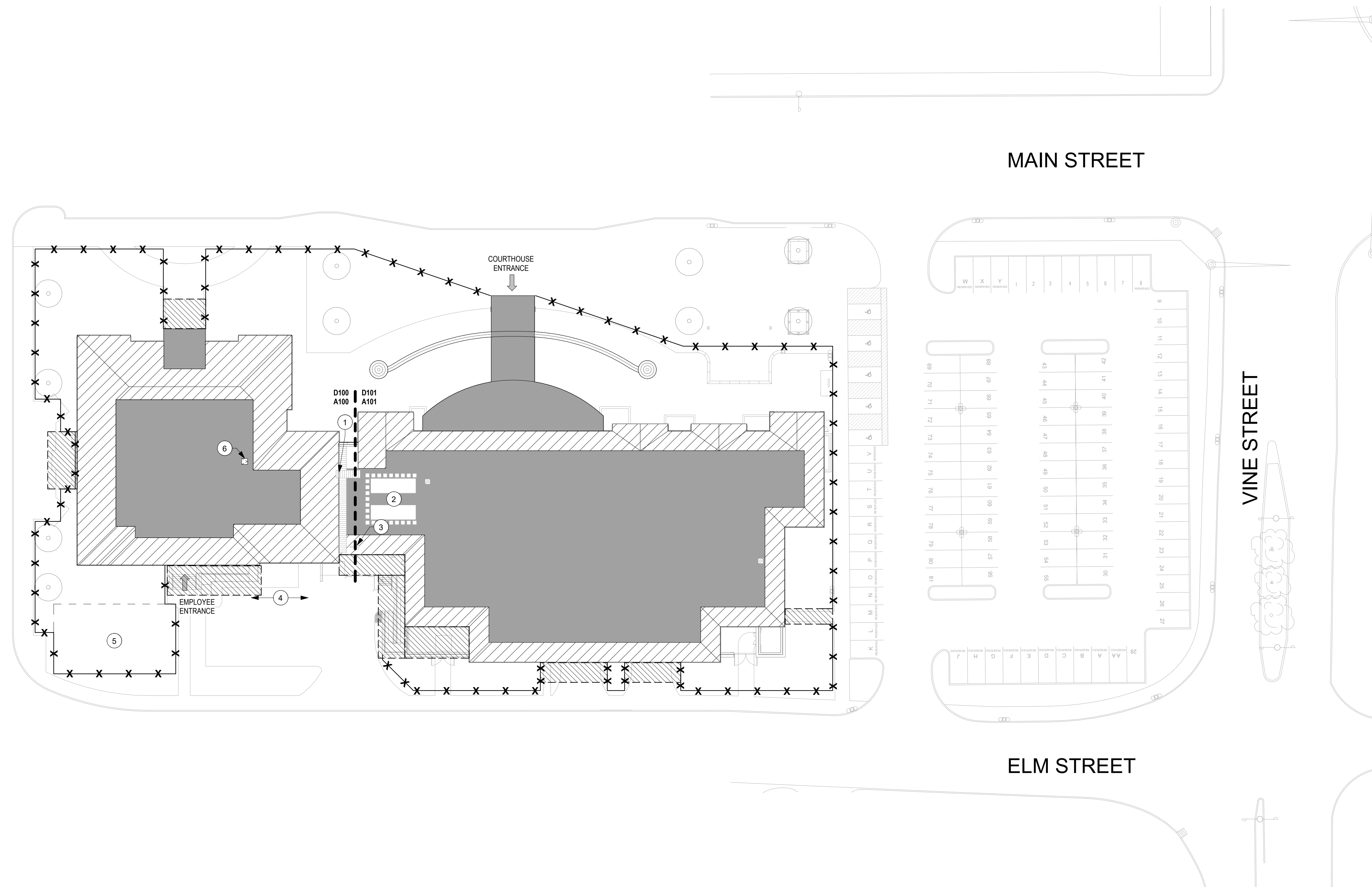
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SITE PLAN NOTES

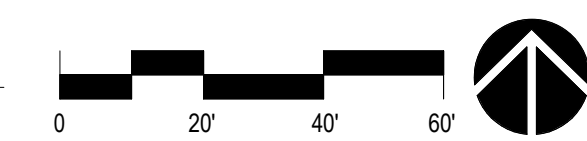
1. ROOF TOP ACCESS
2. EXISTING RTU'S
3. EXISTING ROOF HOIST
4. EMPLOYEE / MAINTENANCE PARKING
5. LAYDOWN AREA
6. ROOF HATCH

SITE PLAN LEGEND

	EXISTING TREE		NOT IN SCOPE
	BUILDING ENTRANCE		AREA OF WORK
	CONSTRUCTION FENCING		OVERHEAD PROTECTIVE SCAFFOLDING



1 ARCHITECTURAL SITE PLAN  
1" = 30'-0"



Issue Date	Issue Date	Title	Title
04/30/21	04/30/21	ISSUE FOR BID	ISSUE FOR BID

CHAMPAIGN COUNTY  
COURTHOUSE ROOF  
REPLACEMENT

101 E MAIN ST  
URBANA, IL 61801

ARCHITECTURAL  
SITE PLAN

BE Project No.  
020156

Drawn By:  
JS

Drawing No.  
G110



GENERAL NOTES

1. PROTECT EXISTING CONSTRUCTION TO REMAIN FROM ANY/ALL DAMAGE.
2. EXISTING COPPER FLASHINGS, GUTTERS, COPINGS AND TRIM TO REMAIN - PROTECT FROM DAMAGE.

SHEET KEYNOTES

- 02.01 REMOVE EXISTING ROOF SHINGLE SYSTEM IN ITS ENTIRETY TO EXISTING ROOF DECK.

DEMOLITION PLAN LEGEND

- AREA NOT IN SCOPE OF WORK
- EXISTING TO BE DEMOLISHED
- EXISTING TO REMAIN

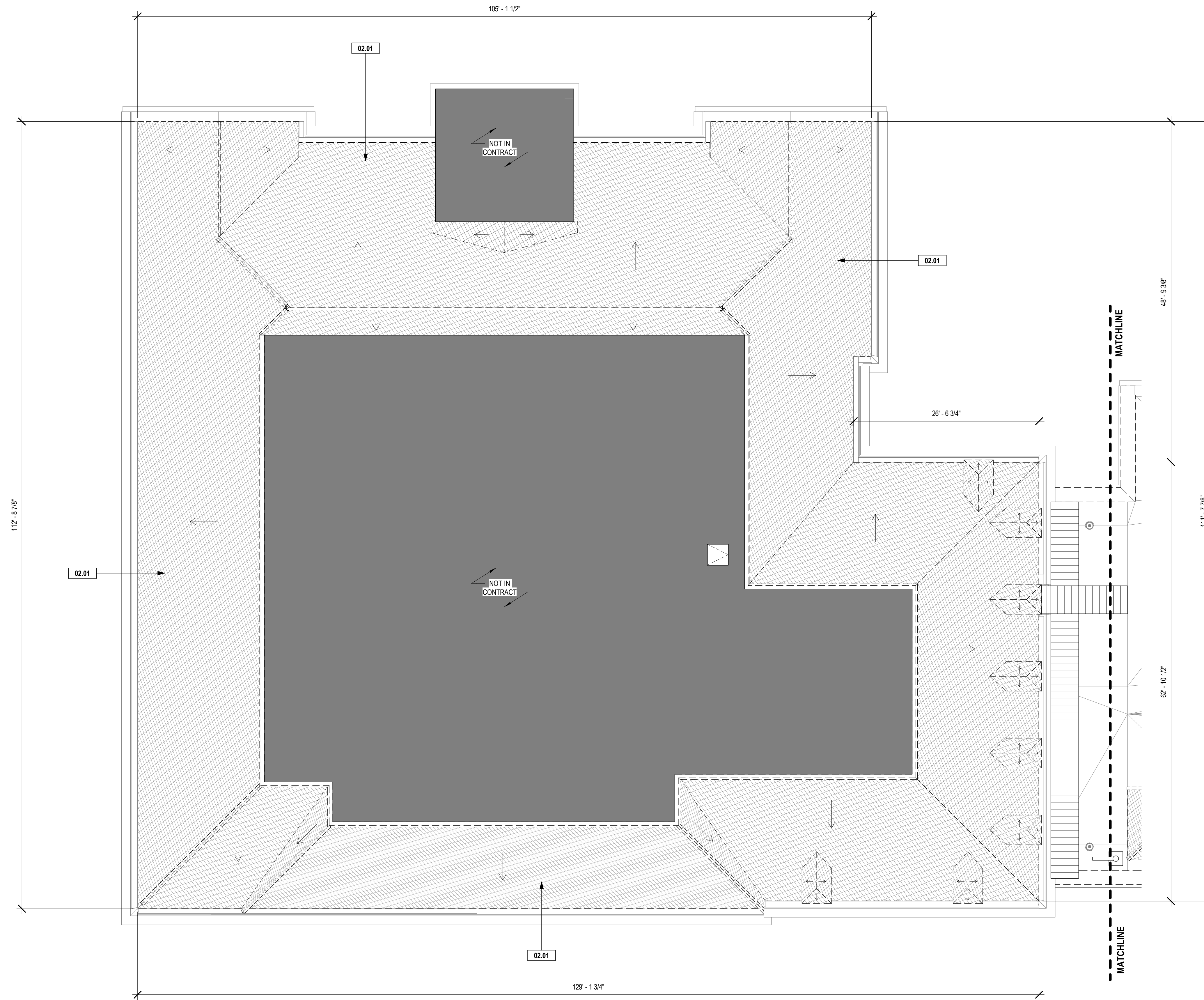


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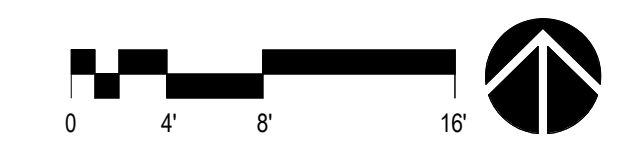
Issue Date	Title
04/30/21	ISSUE FOR BID

CHAMPAIGN COUNTY  
COURTHOUSE ROOF  
REPLACEMENT

101 E MAIN ST  
URBANA, IL 61801

ORIGINAL ROOF PLAN  
- EXISTING/DEMO

1 ORIGINAL ROOF PLAN  
1/8" = 1'-0"




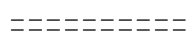

**GENERAL NOTES**

1. PROTECT EXISTING CONSTRUCTION TO REMAIN FROM ANY/ALL DAMAGE.
2. EXISTING COPPER FLASHINGS, GUTTERS, COPINGS AND TRIM TO REMAIN - PROTECT FROM DAMAGE.

**SHEET KEYNOTES**

- 02.01 REMOVE EXISTING ROOF SHINGLE SYSTEM IN ITS ENTIRETY TO EXISTING ROOF DECK.
- 02.02 REMOVE EXISTING DRIP EDGE, FLASHING, AND FASCIA AT MANSARD ROOF AS INDICATED.
- 02.03 REMOVE EXISTING PARAPET CAP FLASHING AT EXISTING EXTERIOR WALL AS INDICATED.

**DEMOLITION PLAN LEGEND**

-  AREA NOT IN SCOPE OF WORK
-  EXISTING TO BE DEMOLISHED
-  EXISTING TO REMAIN

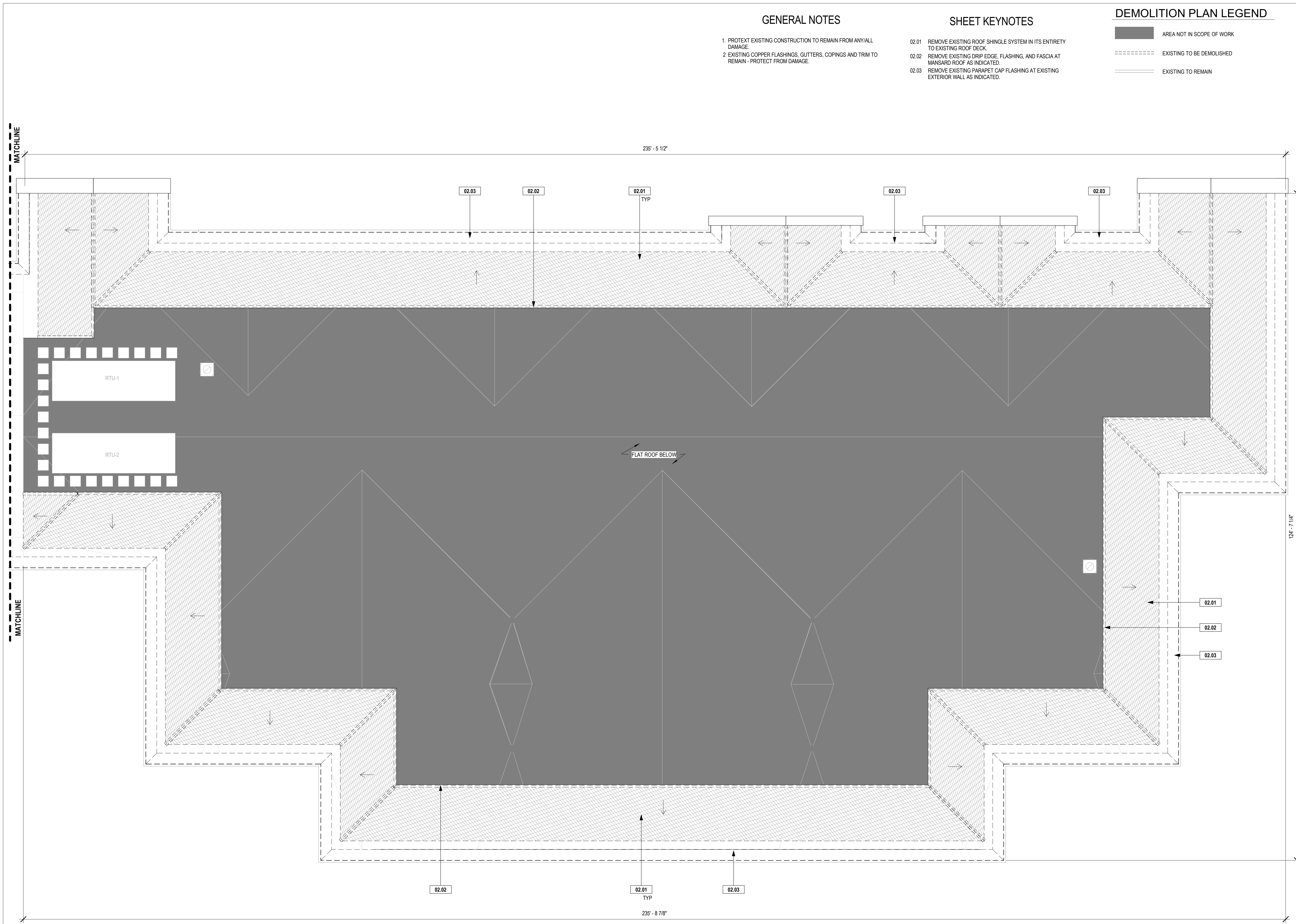


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**CHAMPAIGN COUNTY COURTHOUSE ROOF REPLACEMENT**  
101 E MAIN ST  
URBANA, IL 61801

**ADDITION ROOF PLAN - EXISTING/DEMO**

**1 ADDITION ROOF PLAN**  
1/8" = 1'-0"




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326



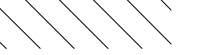

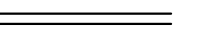
**GENERAL NOTES**

1. PROTECT EXISTING CONSTRUCTION TO REMAIN FROM ANY/ALL DAMAGE.
2. EXISTING COPPER FLASHINGS, GUTTERS, COPINGS AND TRIM TO REMAIN - PROTECT FROM DAMAGE.

**SHEET KEYNOTES**

- 02.01 REMOVE EXISTING ROOF SHINGLE SYSTEM IN ITS ENTIRETY TO EXISTING ROOF DECK.
- 07.01 INSTALL NEW SHINGLE ROOFING THROUGHOUT.
- 07.02 REINSTALL COPPER FLASHING AT EPDM & SHINGLE ROOF INTERSECTION.

**NEW WORK PLAN LEGEND**

-  AREA NOT IN SCOPE OF WORK
-  EXISTING TO REMAIN
-  NEW WORK

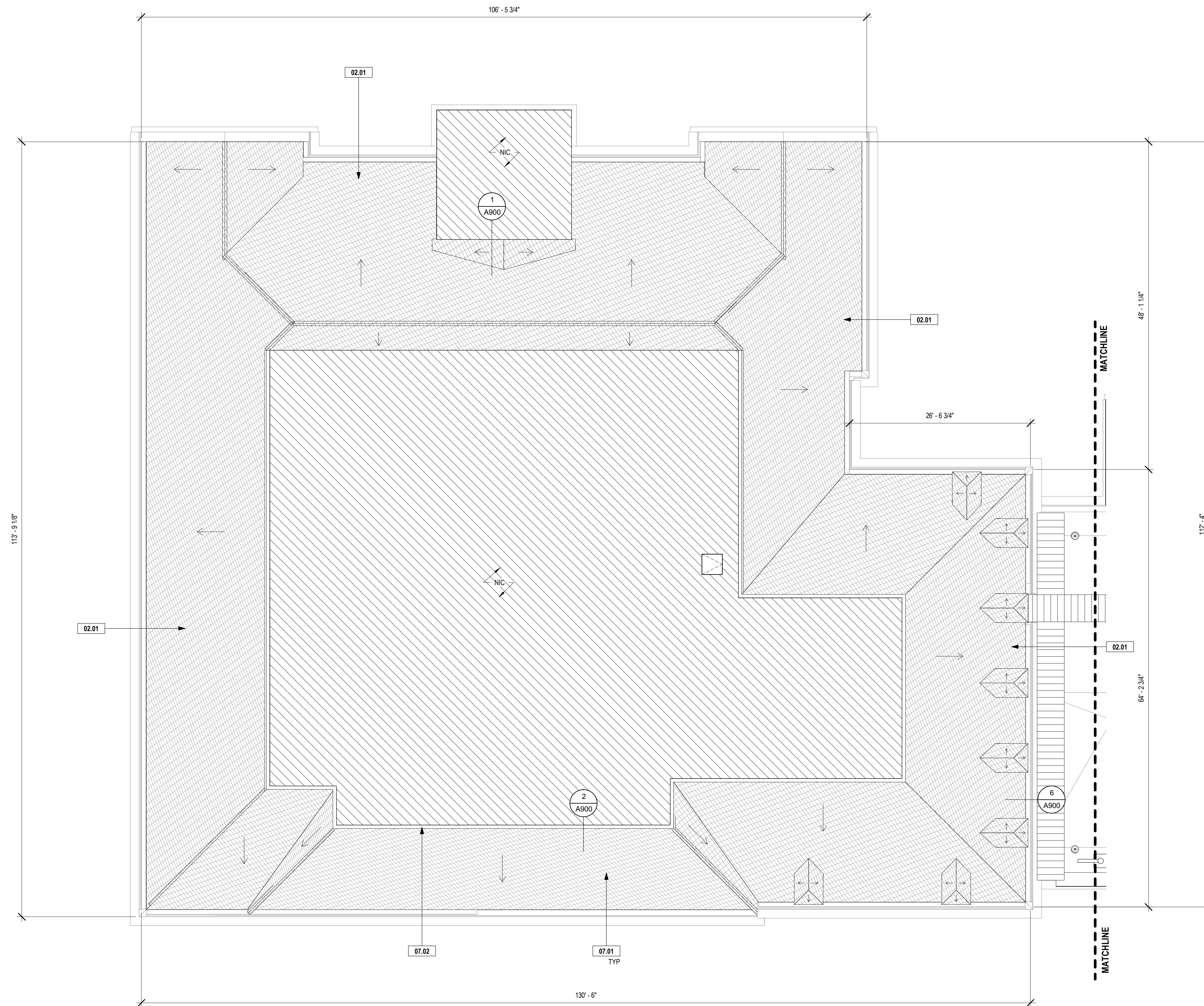


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Issue Date	Issue Title
04/30/21	ISSUE FOR BID

**CHAMPAIGN COUNTY  
COURTHOUSE ROOF  
REPLACEMENT**

101 E MAIN ST  
URBANA, IL 61801

**ORIGINAL ROOF PLAN  
- NEW WORK**

**1 ORIGINAL ROOF PLAN - NEW WORK**  
1/8" = 1'-0"



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327



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GENERAL NOTES

- 1. PROTECT EXISTING CONSTRUCTION TO REMAIN FROM ANY/ALL DAMAGE.
- 2. EXISTING COPPER FLASHINGS, GUTTERS, COPINGS AND TRIM TO REMAIN - PROTECT FROM DAMAGE.

SHEET KEYNOTES

- 07.03 INSTALL NEW PARAPET CAP FLASHING AS INDICATED, REFER TO DETAILS.

NEW WORK PLAN LEGEND

- AREA NOT IN SCOPE OF WORK
- EXISTING TO REMAIN
- NEW WORK

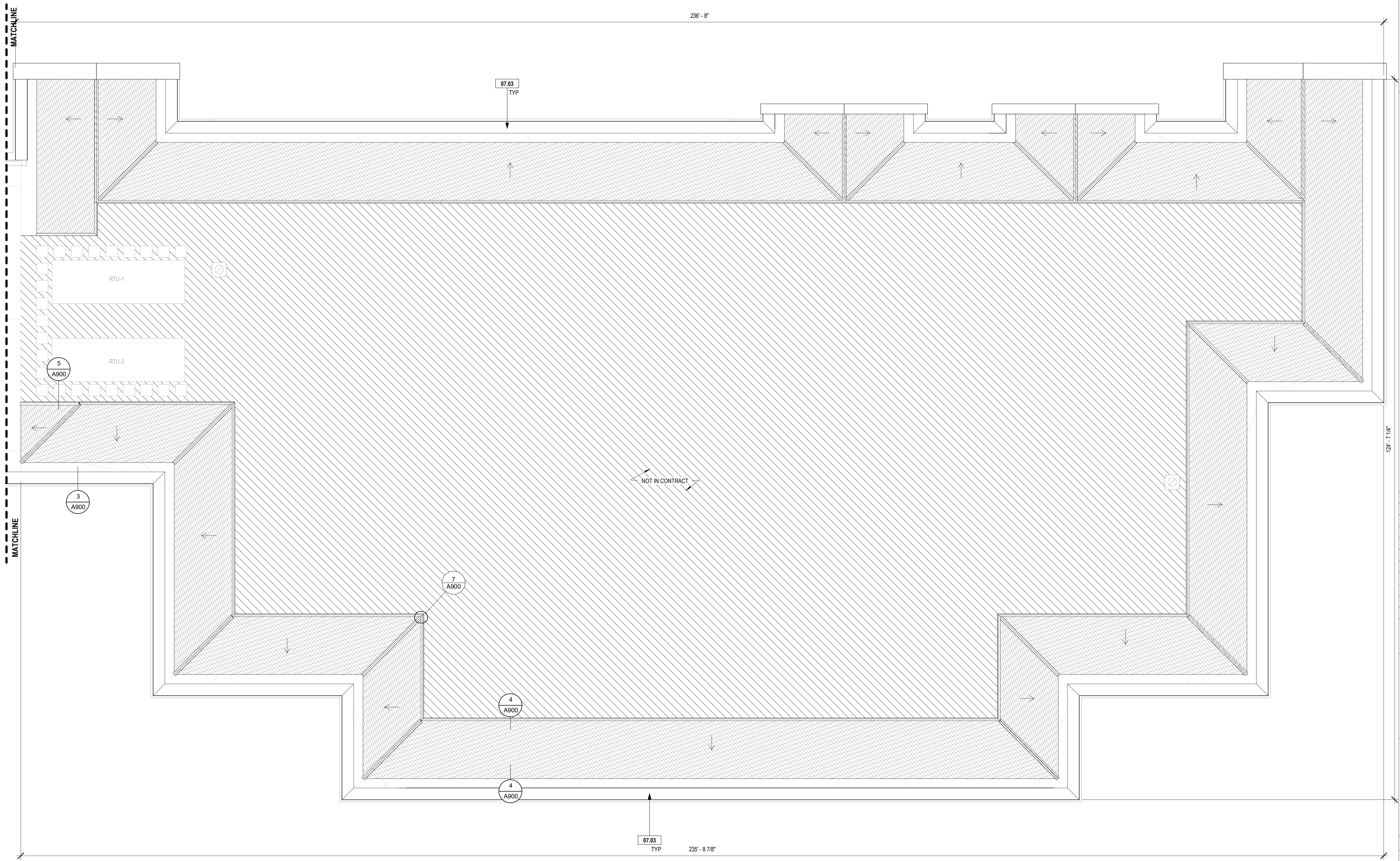


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Issue Date	Issue Date	Title	Title
04/30/21	04/30/21	ISSUE FOR BID	ISSUE FOR BID

CHAMPAIGN COUNTY  
COURTHOUSE ROOF  
REPLACEMENT

101 E MAIN ST  
URBANA, IL 61801

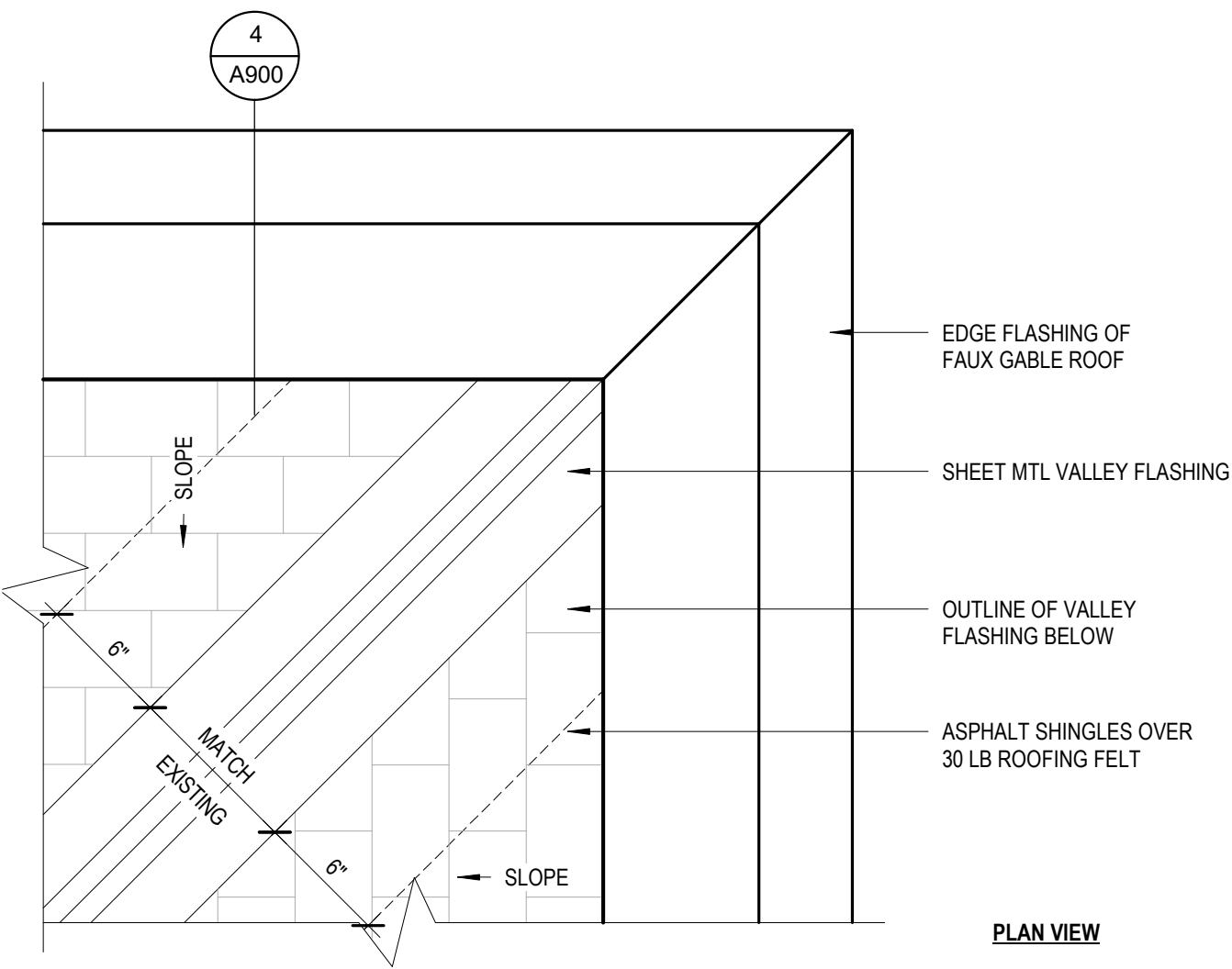
ADDITION ROOF  
PLAN - NEW WORK

1 ADDITION ROOF PLAN - NEW WORK  
1/8" = 1'-0"

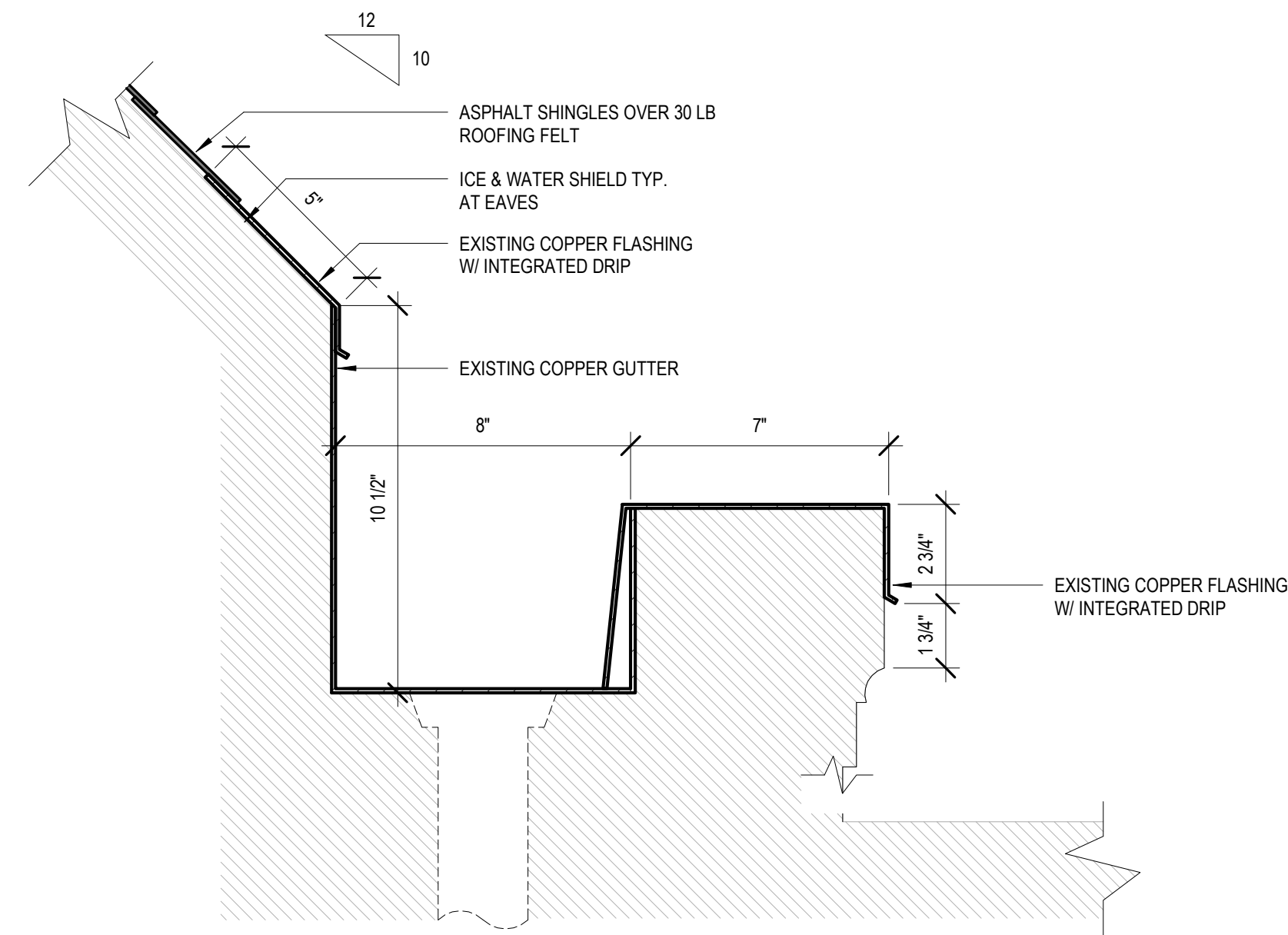


BE Project No. 020156
Drawn By: JS
Drawing No. A101
328

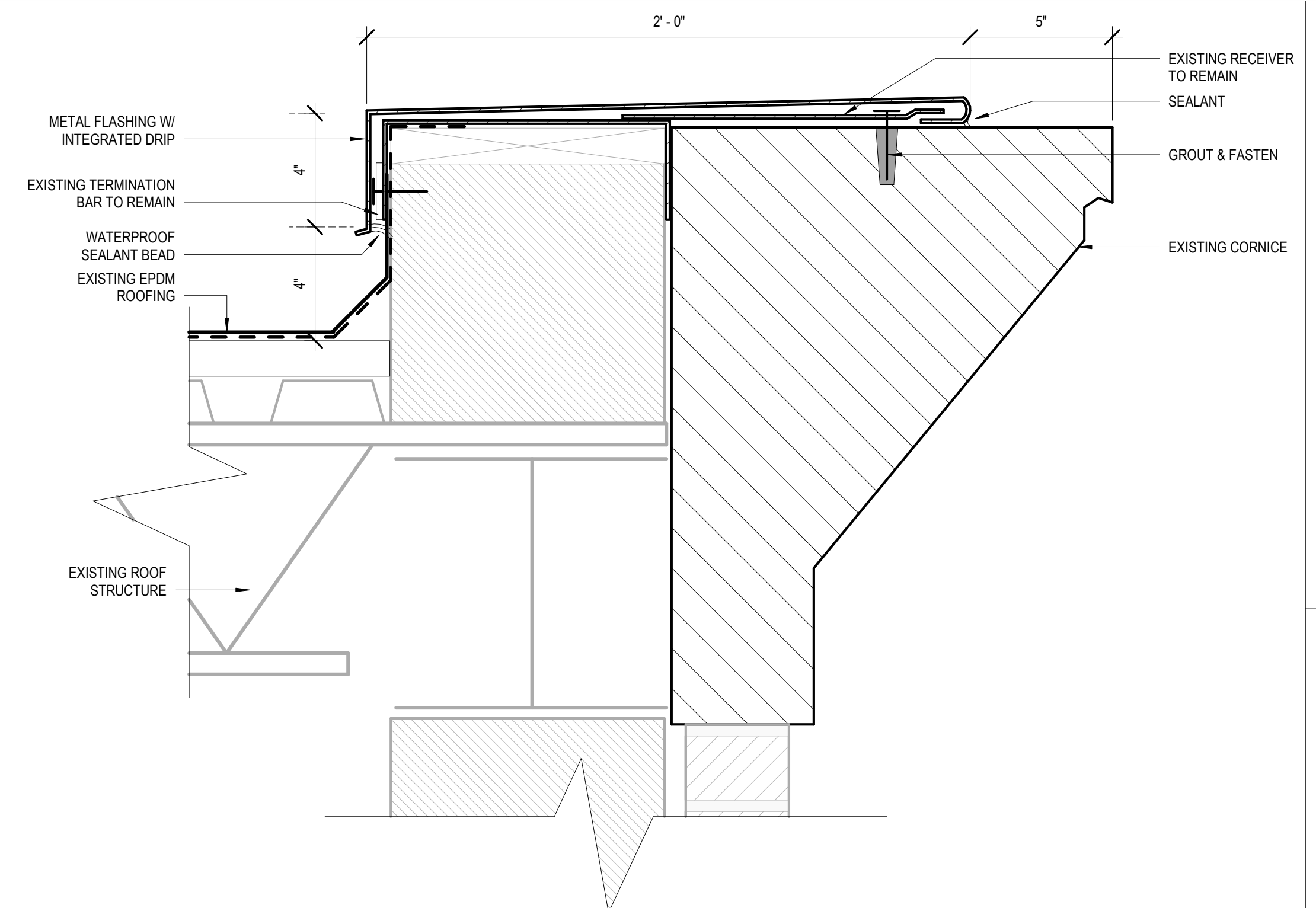
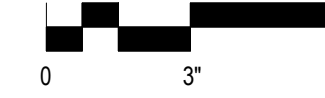




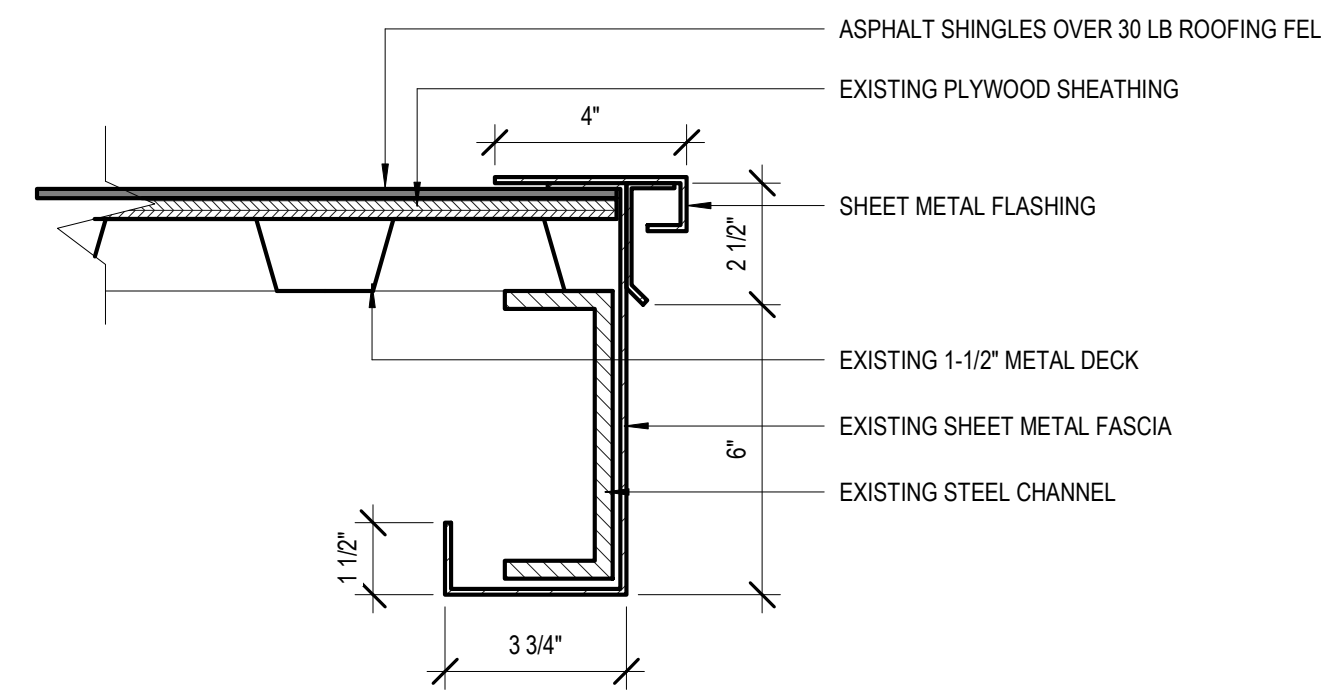
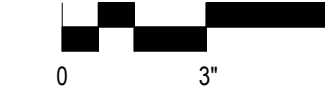
7 VALLEY @ MANSARD ROOF  
3" = 1'-0"



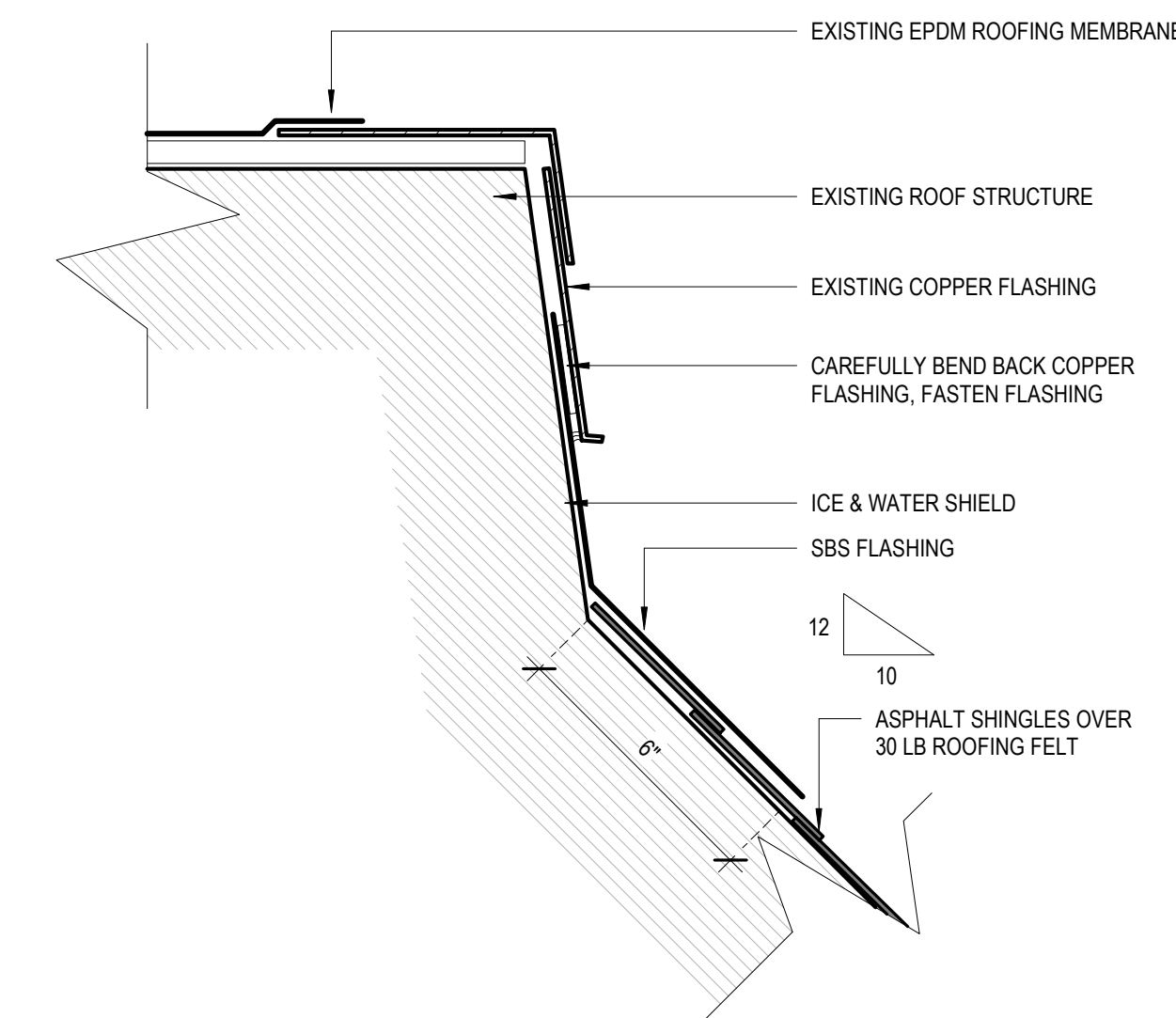
6 GUTTER @ EAST WALL  
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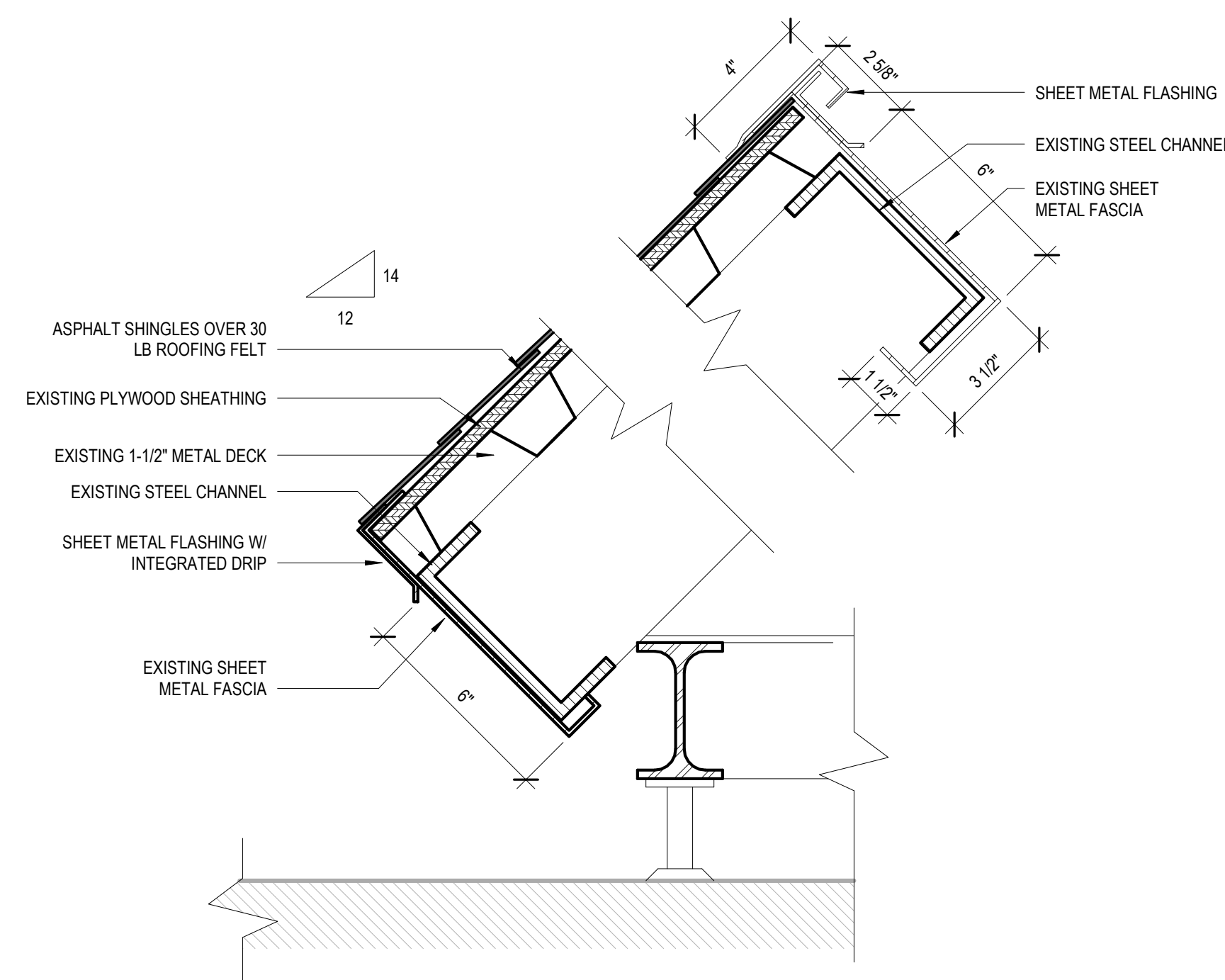
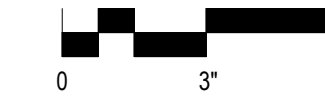
3 DETAIL @ PERIMETER COPING  
3" = 1'-0"



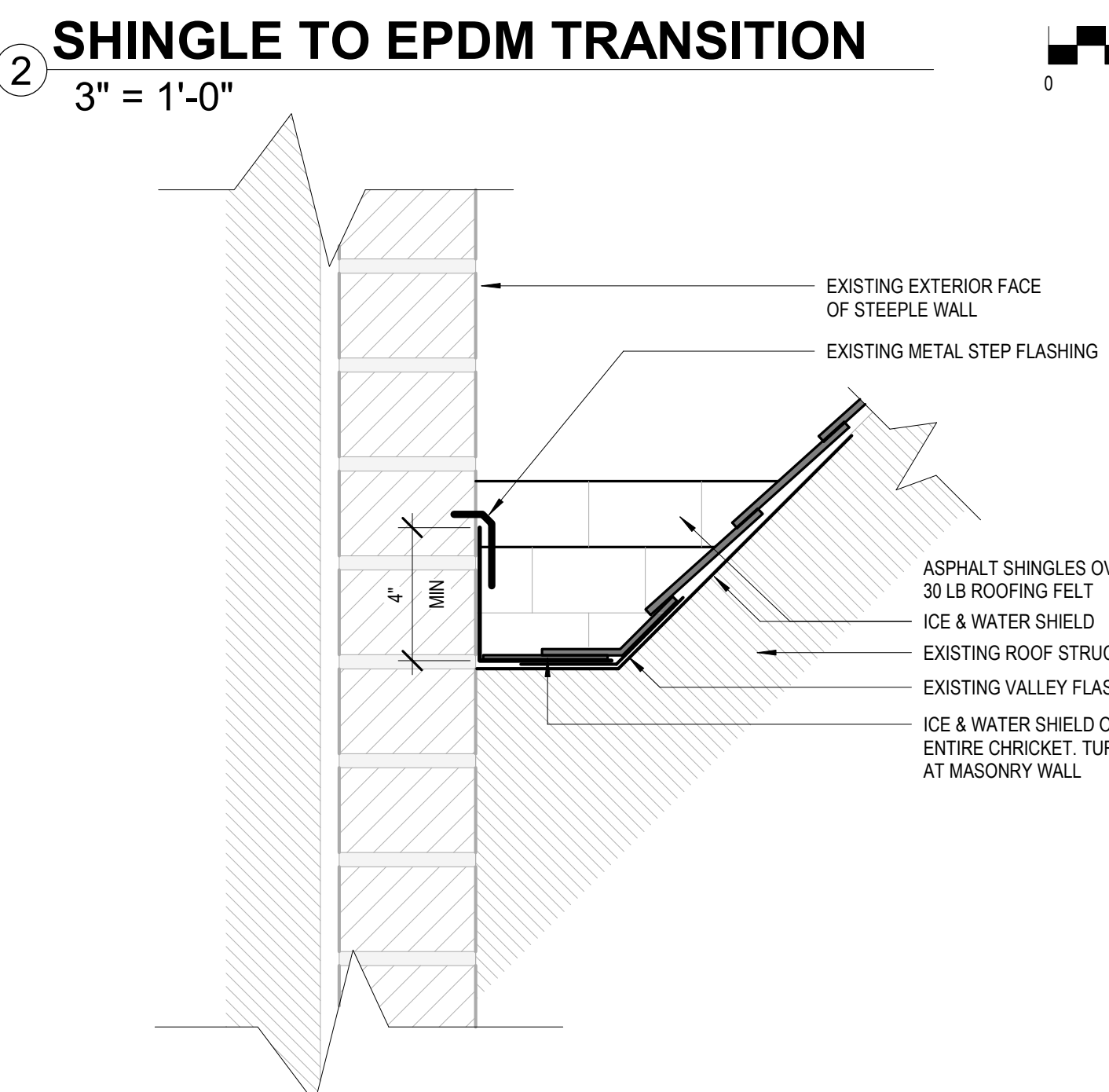
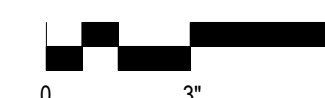
5 RAKE @ MANSARD ROOF  
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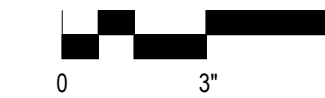
2 SHINGLE TO EPDM TRANSITION  
3" = 1'-0"



4 EDGE DETAIL @ MANSARD ROOF  
3" = 1'-0"



1 SHINGLE @ CLOCK TOWER  
3" = 1'-0"



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Issue Date	Issue Title
04/30/21	ISSUE FOR BID

CHAMPAIGN COUNTY  
COURTHOUSE ROOF  
REPLACEMENT

101 E MAIN ST  
URBANA, IL 61801

Drawing Title

DETAILS

BE Project No.  
020156

Drawn By:  
JS

Drawing No.  
A900

329

**SATELLITE JAIL HVAC REPLACEMENT PROJECT**

**AT**

**502 SOUTH LIERMAN AVENUE  
URBANA, ILLINOIS 61802**

**FOR**

**COUNTY OF CHAMPAIGN  
URBANA, ILLINOIS 61802**

**PROJECT MANUAL  
ITB #2021-003**

**May 5, 2021**

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May 5, 2021

BID: County of Champaign, Illinois  
Hail Damaged HVAC Replacement Project  
**Friday, June 4, 2021**  
**3:00 P.M., Public Opening**  
Lyle Shields Conference Room  
Brookens Administrative Center  
1776 East Washington  
Urbana, Illinois 61802-4581

Dear Bidder:

The County of Champaign is inviting the submission of sealed bids for the Satellite Jail HVAC Replacement Project at 502 South Lierman Avenue, Urbana, IL 61802.

Specifications are prepared with the intent of offering equal opportunity to all bidders. No oral interpretations will be given to any bidder as to the meaning of the specifications. Requests for clarification must be submitted **in writing** via mail, fax or email to:

GHR Engineers and Associates, Inc.  
Attn.: Richard Van Note  
1615 South Neil Street  
Champaign, IL 61820  
Fax: (217) 356-1092  
Email: [rvannote@ghrinc.com](mailto:rvannote@ghrinc.com)

Clarification requests must be received no later than Wednesday, May 28, 2021, 12:00 pm noon to be considered.

Pursuant to the Illinois Prevailing Wage Act (820 ILCS 130/1 et seq.), not less than the prevailing rate of wages as determined by the Illinois Department of Labor, County of Champaign, or court on review shall be paid by the vendor/contractor to all laborers, workers and mechanics performing work under this purchase order.

All bids are to be sealed and in the hands of the undersigned by the due date and time stated above, at which time bids will be publicly opened. There will be no bids accepted after said date and time. Your bid is to be submitted on the bid form provided. The envelope containing your bid is to be sealed and marked in the lower left-hand corner: **“Sealed Bid: Satellite Jail HVAC Replacement Project: HVAC”** or **“Sealed Bid: Satellite Jail HVAC Replacement Project: Controls”**. Bids will not be accepted by FAX mail.

The Champaign County Board reserves the right to reject any or all bids, to accept the bids, or to waive any irregularities should it deem to be in the best interest of the County of Champaign to do so. The bids will be awarded to the lowest responsible bidder meeting specifications as determined by the Champaign County Board.

Sincerely,

Dana Brenner  
Facilities Director

END OF NOTICE TO BIDDERS 00 0200

DOCUMENT 00 1116 - INVITATION TO BID - #2021-003

1.1 PROJECT INFORMATION

A. Notice to Bidders: Qualified bidders are invited to submit bids for Project as described in this Document.

B. Project Identification:  
**Satellite Jail HVAC Replacement Project**

1. Project Location:

502 South Lierman Avenue  
Urbana, IL 61802

C. Owner: County of Champaign

1. Owner's Representative:

**Dana Brenner, Facilities Director**  
1776 East Washington  
Urbana, IL 61802-4581  
Phone: (217) 384-3765  
Fax: (217) 384-3896  
Email: [dbrenner@co-champaign.il.us](mailto:dbrenner@co-champaign.il.us)

D. Project Design Team: GHR Engineers and Associates, Inc.

E. Project Description:

1. HVAC Bid: Project consists of removal of (4) air handling units & associated air-cooled condensing units. (4) new air handlers will be installed in same location. (2) new air cooled chillers to be located on roof. Existing boilers will be removed and replaced with high-efficiency condensing boilers. New penthouse to be constructed for new equipment. Install controls valves provided by controls contractor.
2. Controls Bid: Project consists of removal of existing pneumatic controls. Install new DDC controls on existing and new HVAC equipment. Provide control valves to HVAC contractor for installation.



- F. Construction Contract: Bids will be received for the following Work:

HVAC Contract – Prime  
Controls Contract – Assigned to HVAC Contractor

1.2 BID SUBMITTAL AND OPENING

- A. Owner will receive sealed bids until the bid time and date at the location indicated below. Owner will consider bids prepared in compliance with the Contract Documents issued by Owner, and delivered as follows:

1. **Bid Date: Friday, June 4, 2021.**
2. **Bid Time: 3:00 p.m., local time.**

Location:

**Lyle Shields Conference Room**  
**Brookens Administration Center**  
1776 East Washington  
Urbana, IL 61802

- B. Bids will be thereafter opened in the presence of the bidders and read aloud.

1.3 BID SECURITY

- A. Bid security in the form of a bank draft/cashier's check, certified check, U.S. money order, or bid bond **payable to County of Champaign** shall be submitted with each bid in the amount of **ten (10) percent** of the bid amount. No bids may be withdrawn for a period of **sixty (60) days** after opening of bids. Owner reserves the right to reject any and all bids and to waive informalities and irregularities.

1.4 PREBID CONFERENCE / SITE VISIT

- A. A prebid conference for all bidders will be held at **Lyle Shields Conference Room, Brookens Administration Center, 1776 East Washington, Urbana, Illinois** on Friday, May 21, 2021 at 3:00 pm, local time. Meet at front entrance.

- B. Building access for additional site visits may be made by contacting Owner's Representative.

Dana Brenner, Facilities Director  
Phone: 217-384-3765  
Fax: 217-384-3896  
E-mail: [dbrenner@co-champaign.il.us](mailto:dbrenner@co-champaign.il.us)

#### 1.5 DOCUMENTS

- A. Documents can be procured by emailing Shannon Hicks, [shicks@ghrinc.com](mailto:shicks@ghrinc.com). All documents will be in pdf form by email only.

#### 1.6 TIME OF COMPLETION

- A. Bidders shall begin the Work on receipt of the Notice to Proceed and shall complete the Work within the Contract Time.
  1. Anticipated Award of Contract: Board Meeting, **Thursday, June 24, 2021.**
  2. Anticipated Letter of Notice of Award: On or about **Friday, July 2, 2021.**
  3. Pre-Construction/Pre-Installation Meeting: TBD.
  4. **Substantial Completion: Friday, November 12, 2021.**
  5. Punch List: Issued on or about **Tuesday, November 16, 2021.**
  6. **Final Completion: Tuesday, November 30, 2021.**

#### 1.7 BIDDER'S QUALIFICATIONS

- A. Bidders must be properly licensed under the laws governing their respective trades and be able to obtain insurance and bonds required for the Work. **A Performance Bond, a separate Labor and Material Payment Bond, and Insurance in a form acceptable to Owner will be required of the successful Bidder.**

END OF DOCUMENT 00 1116

## DOCUMENT 00 2213 - SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

### 1.1 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS - BIDDER'S REPRESENTATIONS

- A. The Bidder has investigated all required fees, permits, and regulatory requirements of authorities having jurisdiction and has properly included in the submitted bid the cost of such fees, permits, and requirements not otherwise indicated as provided by Owner.
  - 1. Permit Application: Complete building permit application and file with authorities having jurisdiction within five days of the Notice of Ward.
- B. The Bidder is a properly licensed Contractor according to the laws and regulations of The State of Illinois and meets qualifications indicated in the Procurement and Contracting Documents.
- C. The Bidder has incorporated into the Bid adequate sums for work performed by installers whose qualifications meet those indicated in the Procurement and Contracting Documents.

### 1.2 BIDDING DOCUMENTS

- A. Interpretation or Correction of Procurement and Contracting Documents:
  - 1. Submit Bidder's Requests for Interpretation as outlined in the Notice to Bidders.
- B. Submit Requests for Substitution on form provided. Substitution requests shall be in advance of bid.
- C. Addenda:
  - 1. Addenda may be issued at any time prior to the receipt of bids.
  - 2. Owner may elect to waive the requirement for acknowledging receipt of Addenda as follows:
    - a. Information received as part of the Bid indicates that the Bid, as submitted, reflects modifications to the Procurement and Contracting Documents included in an unacknowledged Addendum.

- b. Modifications to the Procurement and Contracting Documents in an unacknowledged Addendum do not, in the opinion of Owner, affect the Contract Sum or Contract Time.

### 1.3 BIDDING PROCEDURES

#### A. Preparation of Bids:

1. The Bid shall include unit prices when called for by the Procurement and Contracting Documents. Owner may elect to consider unit prices in the determination of award. Unit prices will be incorporated into the Contract.
2. Owner may elect to disqualify a bid due to failure to submit a bid in the form requested, failure to bid requested alternates or unit prices, failure to complete entries in all blanks in the Bid Form, or inclusion by the Bidder of any alternates, conditions, limitations or provisions not called for.

**Retail sales tax will NOT be included in the bid amount.** The Owner is exempted by Section 3 of the Illinois Use Tax Act (Section 3, House Bill 1610, approved July 31, 1961, Illinois Revised Statutes 1967, Chapter 120, Section 439.3) from paying any of the taxes imposed by the Act and sales to Owner are exempt by Section 2, House Bill 1609, approved July 31, 1961, Illinois Revised statutes 1967, Chapter 120, Section 441) from any of the taxes imposed by the Act. The Department of Revenue of the State of Illinois under Rule No. 15, issued August 9, 1961, has declared that sales of materials to construction contractors for conversion into real estate for schools, governmental bodies, agencies and instrumentalities are not taxable retail sales. **The Contractor shall be responsible for any sales, consumer, use and similar taxes for the Work.**

3. Owner is not responsible for any costs incurred by a Contractor in the preparation or delivery of bids. The Contractor shall be responsible for the actual delivery of bids during business hours to the address indicated. Any bid received after the delivery deadline will be disqualified.
4. Owner reserves the right to obtain clarification of any point in a Contractor submittal or to obtain additional information.

FOIA: As an independent Contractor of the District, records in the possession of the Contractor related to this Agreement may be subject to the Illinois Freedom of Information Act ("FOIA"), 5 ILCS 140/5-1 et seq.; 5 ILCS 140/7(2). The Contractor shall immediately provide the District with any such records

requested by the District in order to timely respond to any FOIA request received by the District.

B. Subcontractors, Suppliers, and Manufacturers List Bid Supplement:

1. Provide list of major subcontractors, suppliers, and manufacturers furnishing or installing products no later than **ten (10) business days** following Notice to Proceed. Do not change subcontractors, suppliers, and manufacturers from those submitted without approval of Owner.

1.4 CONSIDERATION OF BIDS

A. Rejection of Bids:

Owner reserves the right to reject a bid based on Owner's and Design Team's evaluation of qualification information submitted following opening of bids. Owner's evaluation of the Bidder's qualifications will include: status of licensure and record of compliance with licensing requirements, record of quality of completed work, record of Project completion and ability to complete, record of financial management including financial resources available to complete Project and record of timely payment of obligations, record of Project site management including compliance with requirements of authorities having jurisdiction, record of and number of current claims and disputes and the status of their resolution, and qualifications of the Bidder's proposed Project staff and proposed subcontractors.

1.5 PERFORMANCE BOND AND PAYMENT BOND

- A. Both a Performance Bond and a Payment Bond will be required, each in an amount equal to 100 percent of the Contract Sum.
- B. The Bidder shall deliver the required bonds to Owner no later than **ten (10)** days after the date of Notice of Intent to Award and no later than the date of execution of the Contract, whichever occurs first. Owner may deem the failure of the Bidder to deliver required bonds within the period of time allowed a default.
- C. Bonds shall be executed and be in force on the date of the execution of the Contract.

## 1.6 INSURANCE

- A. The Contractor shall take all necessary precautions and exercise due caution so as not to damage the premises or properties of others. The Contractor's signature on the bid sheet certifies to the District that the Contractor has adequate insurance coverage for any vehicle that may be utilized in the delivery of products or materials on the District's property. The Contractor shall submit evidence, satisfactory to the District, that the Contractor has coverage of General Liability Insurance, Worker's Compensation Insurance, and Automobile Liability Insurance to the limits described below with companies licensed to do business in Illinois with an A.M. Best rating of A that is satisfactory to the District. The certificates of such insurance shall carry an endorsement to the effect that the Insurance Company will defend the District as a party in the event the successful bidder becomes a party to any litigation as a result of the activities of the Contractor, subcontractor, or any direct or indirect employee of same under the terms of this contract for injuries to property or person. Such policies shall name the District, its Board, Board members, employees, agents, and successors as an additional insured and provide that it is primary to, and not contributing with, any policy carried by Contractor covering the same loss with a waiver of subrogation in favor of the School District. The Contractor shall provide Certificates of Insurance for:
1. Vehicular: It is required that the successful Contractor present to the District, before commencing delivery under this Contract, a Certificate of Insurance covering all vehicles that may be utilized. Said insurance is to provide a \$1,000,000 combined single limit for bodily injury and property damage. All certificates shall indicate that the carrying company shall not cancel insurance coverage without giving Owner thirty (30) days written advance notification.
  2. Liability: It is required that the successful Contractor present to the District, **before commencing delivery under this Contract**, a Certificate of Insurance for which coverage is included for contractor liability, contingent liability, contractual liability, and product liability. Bodily injury and property damage limits of \$1,000,000 occurrence and \$2,000,000 aggregate. Said Certificate shall indicate that the carrying company shall not cancel insurance coverage without giving District thirty (30) days written advance notice.
  3. Worker's Compensation: Statutory Limits.

## 1.7 STANDARD CONTRACT CONDITIONS

- A. This contract shall be governed in all aspects as to validity, construction, capacity, performance, or otherwise by the laws of the State of Illinois.

- B. Contractors shall comply with the Civil Rights Act of 1964, as amended, all applicable State and Federal non-discrimination laws including but not limited to the Family and Medical Leave Act, the Americans with Disabilities Act, the Age Discrimination in Employment Act and shall comply with the provisions of the Illinois Human Rights Act.
- C. Contractors shall not assign, transfer, convey, sublet, or otherwise dispose of this contract, including any or all of it right, title or interest therein, or its power to execute such contract to any person, company or corporation, without prior written consent of The County of Champaign.
- D. By submitting a bid the Contractor certifies that the Contractor is not barred from bidding on this contract as a result of a violation of either the bid-rigging or bid-rotating provisions of Article 33E of the Criminal Code of 1961, as amended.

By submitting a bid, the Contractor, having 25 or more employees, does hereby certify pursuant to Section 3 of the Illinois Drug-Free Workplace Act (30 ILCS 580/3) that it shall provide a drug-free workplace for all employees engaged in the performance of work under the contract by complying with the requirements of the Illinois Drug-Free Workplace Act and, further certifies, that it is not ineligible for award of this contract by reason of debarment for a violation of the Illinois Drug-Free Workplace Act.

- E. By submitting a bid, the Contractor does hereby certify pursuant to Section 2-105 of the Illinois Human Rights Act (775 ILCS 5/2-105) that it has a written sexual harassment policy that includes, at a minimum, the following information: (i) the illegality of sexual harassment; (ii) the definition of sexual harassment under State law; (iii) a description of sexual harassment, utilizing examples; (iv) an internal complaint process including penalties; (v) the legal recourse, investigative and complaint process available through the Department of Human Rights and Human Rights Commission; (vi) direction on how to contact the Department of Human Rights and Human Rights Commission; and (vii) protection against retaliation.

#### 1.8 STATEMENT OF NON-DISCRIMINATION

- A. The Illinois Human Rights Acts prohibits discrimination on the basis of: “race, color, religion, sex, national origin, ancestry, age, order of protection status, marital status, physical or mental disability, military status, sexual orientation, or unfavorable discharge from military service in connection with employment, real estate transactions, access to financial credit, and the availability of public accommodations.” It also prohibits sexual harassment and discrimination in employment on the basis of citizenship status.

## 1.9 PREVAILING WAGE

- A. This contract calls for the construction of a “public work” within the meaning of the Illinois Prevailing Wage Act, 920 ILCS 130/.01. The Act requires contractors and subcontractors to pay al laborers, workers and mechanics performing services on public works projects no less than the “prevailing rate of wages” (hourly cash wages plus fringe benefits) in the county where the work is performed. Each Contractor and Subcontractor rendering services under this contract must comply with all requirements of this Act. Each Contractor and Subcontractor shall keep records of the prevailing wages paid to their employees, submit a monthly certified payroll to County of Champaign, and make such records available to County of Champaign for inspection upon seven business days notice.
- B. For information regarding the current prevailing wage rates for Champaign County, Illinois can be found at:  
  
<http://www.illinois.gov/idol/laws-rules/conmed/pages/rates.aspx>.
- C. Prevailing Wage Rates change periodically. Contractor shall verify and revise the prevailing wages on a regular basis.

## 1.10 FAILURE TO FULFILL CONTRACT

- A. When any Contractor fails to provide a service or provides a service which does not conform to the specifications, County of Champaign may, at its sole discretion, annul and set aside the contract entered into with said Contractor, either in whole or in part, and make and enter into a new contract for the same services in such manner as seems to County of Champaign to be to its best advantage. Any failure to furnish services by reason of the failure of the Contractor, as stated above, shall be a liability against such Contractor and his sureties. County of Champaign reserves the right to cancel, without penalty, any services which the successful Contractor may be unable to furnish because of economic conditions, governmental regulations or other similar causes beyond the control of the Contractor provided satisfactory proof is furnished to County of Champaign if requested.
- B. Without Cause Termination: The County may terminate its contract with the Contractor without cause after providing the Contractor with thirty (30) days written notice.



#### 1.11 EXECUTION OF THE CONTRACT

- A. Subsequent to the Notice of Intent to Award, and within **ten (10) business days** after the prescribed Form of Agreement is presented to the Awardee for signature, the Awardee shall execute and deliver the Agreement to Owner through Architect, in such number of counterparts as Owner may require.
- B. Owner may deem as a default the failure of the Awardee to execute the Contract and to supply the required bonds and insurance when the Agreement is presented for signature within the period of time allowed.
- C. Unless otherwise indicated in the Procurement and Contracting Documents of the executed Agreement, the date of commencement of the Work shall be the date of the executed Agreement.  
In the event of a default, Owner may declare the amount of the Bid security forfeited and elect to either award the Contract to the next responsible bidder or re-advertise for bids.

#### 1.12 INDEMNITY

- A. To the fullest extent permitted by law, Contractor shall indemnify and hold harmless the Owner from and against claims, damages, losses and expenses, including but not limited to attorney's fees, arising out of or resulting from performance of the work provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property, but only to the extent caused by the negligent acts or omissions of the Contractor, a subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim damage, loss or expense is caused in part by a party indemnified hereunder.

END OF DOCUMENT 00 2213

## DOCUMENT 00 3119 - EXISTING CONDITION INFORMATION

### 1.1 EXISTING CONDITION INFORMATION

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of the Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.
- B. Photographic report of existing conditions that includes photographic documentation on existing conditions is appended to this Document.

END OF DOCUMENT 00 3119

DOCUMENT 00 4113 - BID FORM - STIPULATED SUM (SINGLE-PRIME CONTRACT)

1.1 BID INFORMATION

- A. Bidder: \_\_\_\_\_.
- B. Project Name: **Satellite Jail HVAC Replacement Project**
- C. Project Location: 502 South Lierman Avenue  
Urbana, Illinois 61802
- D. Owner: County of Champaign
- E. Building Design Team: GHR Engineers and Associates, Inc.

1.2 CERTIFICATIONS AND BASE BID

- A. Controls Bid, Single-Prime (All Trades) Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by the Design Team, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:
  - 1. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).

**Bidders Note: Show bid amount in both words and figures. All spaces must be completed.**

1.3 BID GUARANTEE

- A. The undersigned Bidder agrees to execute a contract for this Work in the above amount and to furnish surety as specified within **ten (10)** days after a written Notice of Award, if offered within **sixty (60)** days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached bank draft/cashier's check, certified check, U.S. money order, or bid bond **payable to County of Champaign**, as liquidated damages for such failure, in an amount constituting **ten percent (10%)** of the Base Bid amount:
  - 1. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).

- B. In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the bank draft/cashier's check, certified check, U.S. money order, or bid bond.
- C. The Owner reserves the right to accept or not accept Alternate Bids 1 and 2 in whatever order best serves the County's needs.

1.4 TIME OF COMPLETION

- A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Owner, and shall fully complete the Work as indicated in the Invitation to Bid.

1.5 ACKNOWLEDGEMENT OF ADDENDA

- A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:
  - 1. Addendum No. 1, dated \_\_\_\_\_.
  - 2. Addendum No. 2, dated \_\_\_\_\_.
  - 3. Addendum No. 3, dated \_\_\_\_\_.

1.6 CONTRACTOR'S LICENSE

- A. The undersigned warrants that he/she is duly authorized to bind contractually the entity submitting this bid, to fully perform all duties and to deliver all services in accordance with the terms and conditions set forth herein. All signatures to be sworn before a Notary Public.

1.7 SUBMISSION OF BID

Respectfully submitted this \_\_\_\_ day of \_\_\_\_\_, 2021.

Submitted By: \_\_\_\_\_  
(Name of bidding firm or corporation)

Authorized  
Signature: \_\_\_\_\_  
(Handwritten signature)

Signed By: \_\_\_\_\_  
(Type or print name)

Title: \_\_\_\_\_  
(Owner/Partner/President/Vice President)

Witness By: \_\_\_\_\_  
(Handwritten signature)

Attest: \_\_\_\_\_  
(Handwritten signature)

By: \_\_\_\_\_  
(Type or print name)

Subscribed and sworn to before me this  
\_\_\_\_\_ Day of \_\_\_\_\_, 2021.

\_\_\_\_\_, Notary Public

(Affix Notary Seal Here)

DOCUMENT 00 4113 - BID FORM - STIPULATED SUM (SINGLE-PRIME CONTRACT)

1.1 BID INFORMATION

- A. Bidder: \_\_\_\_\_.
- B. Project Name: **Satellite Jail HVAC Replacement Project**
- C. Project Location: 502 South Lierman Avenue  
Urbana, Illinois 61802
- D. Owner: County of Champaign
- E. Building Design Team: GHR Engineers and Associates, Inc.

1.2 CERTIFICATIONS AND BASE BID

- A. HVAC Bid, Single-Prime (All Trades) Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by the Design Team, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:
  - 1. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).

**Bidders Note: Show bid amount in both words and figures. All spaces must be completed.**

1.3 BID GUARANTEE

- A. The undersigned Bidder agrees to execute a contract for this Work in the above amount and to furnish surety as specified within **ten (10)** days after a written Notice of Award, if offered within **sixty (60)** days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached bank draft/cashier's check, certified check, U.S. money order, or bid bond **payable to County of Champaign**, as liquidated damages for such failure, in an amount constituting **ten percent (10%)** of the Base Bid amount:
  - 1. \_\_\_\_\_ Dollars (\$\_\_\_\_\_).

- B. In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the bank draft/cashier's check, certified check, U.S. money order, or bid bond.
- C. The Owner reserves the right to accept or not accept Alternate Bids 1 and 2 in whatever order best serves the County's needs.

1.4 TIME OF COMPLETION

- A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Owner, and shall fully complete the Work as indicated in the Invitation to Bid.

1.5 ACKNOWLEDGEMENT OF ADDENDA

- A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:
  - 1. Addendum No. 1, dated \_\_\_\_\_.
  - 2. Addendum No. 2, dated \_\_\_\_\_.
  - 3. Addendum No. 3, dated \_\_\_\_\_.

1.6 CONTRACTOR'S LICENSE

- A. The undersigned warrants that he/she is duly authorized to bind contractually the entity submitting this bid, to fully perform all duties and to deliver all services in accordance with the terms and conditions set forth herein. All signatures to be sworn before a Notary Public.

1.7 SUBMISSION OF BID

Respectfully submitted this \_\_\_\_ day of \_\_\_\_\_, 2021.

Submitted By: \_\_\_\_\_  
(Name of bidding firm or corporation)

Authorized  
Signature: \_\_\_\_\_  
(Handwritten signature)

Signed By: \_\_\_\_\_  
(Type or print name)

Title: \_\_\_\_\_  
(Owner/Partner/President/Vice President)

Witness By: \_\_\_\_\_  
(Handwritten signature)

Attest: \_\_\_\_\_  
(Handwritten signature)

By: \_\_\_\_\_  
(Type or print name)

Subscribed and sworn to before me this  
\_\_\_\_\_ Day of \_\_\_\_\_, 2021.

\_\_\_\_\_, Notary Public

(Affix Notary Seal Here)



## DOCUMENT 00 4313 - BID SECURITY FORMS

### 1.1 BID FORM SUPPLEMENT

- A. A completed bid bond form is required to be attached to the Bid Form.

### 1.2 BID BOND FORM

- A. AIA Document A310, "Bid Bond," is the recommended form for a bid bond. A bid bond acceptable to Owner, is required to be attached to the Bid Form as a supplement.
- B. Copies of AIA standard forms may be obtained from The American Institute of Architects; [www.aia.org/contractdocs/purchase/index.htm](http://www.aia.org/contractdocs/purchase/index.htm); email: [docspurchases@aia.org](mailto:docspurchases@aia.org); (800) 942-7732.

END OF DOCUMENT 00 4313

## SECTION 01 1000 - SUMMARY

### PART 1 - GENERAL

#### 1.1 PROJECT INFORMATION

A. Project Identification: **Satellite Jail HVAC Replacement Project**

1. Project Location:

502 South Lierman Avenue  
Urbana, Illinois 61802

B. Owner: County of Champaign

C. Design Team: GHR Engineers and Associates, Inc.

D. Project Description:

1. HVAC Bid: Project consists of removal of (4) air handling units & associated air-cooled condensing units. (4) new air handlers will be installed in same location. (2) new air cooled chillers to be located on roof. Existing boilers will be removed and replaced with high-efficiency condensing boilers. New penthouse to be constructed for new equipment. Install controls valves provided by controls contractor.
2. Controls Bid: Project consists of removal of existing pneumatic controls. Install new DDC controls on existing and new HVAC equipment. Provide control valves to HVAC contractor for installation.

#### 1.2 WORK RESTRICTIONS

Contractor's Use of Premises: During construction, Contractor will have limited use of site and building indicated. Contractor's use of premises is limited only by Owner's right to perform work or employ other contractors on portions of Project and as follows:

1. Owner will occupy premises during construction. Perform construction only during normal working hours 8 AM to 5 PM Monday thru Friday, other than holidays, unless otherwise agreed to in advance by Owner. Clean up work areas and return to usable condition at the end of each work period.
2. Limits: Limit site disturbance.

3. Driveways, Walkways, and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
- B. On-Site Work Hours: Limit work in the building to normal business working hours of 8 AM to 5 PM, Monday through Friday, unless otherwise indicated.
    1. Weekend Hours: As permitted by Owner. Coordinate with Owner.
    2. Early Morning Hours: 7 AM or as permitted by Owner. Coordinate with Owner.
    3. 24 hour work may be necessary during AHU switchover. Coordinate with Owner.
  - C. Nonsmoking Building: Smoking is not permitted within the building or on the project site.

### 1.3 SITE

- A. Contractor Job Trailer located to South of Building. Location shown on drawings.
- B. Crane to be located on East side of Building. Location shown on drawings.
- C. Workers to park in Brookens Parking Lot. Location shown on drawings.

### 1.4 UTILITIES

- A. Electrical for Job Trailer responsibility of contractor.
- B. Contractor to provide porta-toilet near job trailer.

### 1.5 BACKGROUND CHECKS

- A. All workers to work within the building will be required to have a background check. Checks will be performed by the Sheriff's Office. No fee to the contractor.

### 1.6 AHU WORK SCHEDULE

- A. Schedule has allowed for a 1 week shutdown for each switchover of each AHU.
- B. AHU switch over will be performed in the following order: AHU-4, AHU-3, AHU-2, and AHU-1.

1.7 MISC

- A. Contractor to keep job site cleaned of loose debris.
- B. Contractor tools and equipment to be secured nightly.
- C. Protect roof and repair damage as needed.
- D. Protect fire-safing during work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 1000

## SECTION 01 2000 - PRICE AND PAYMENT PROCEDURES

### PART 1 - GENERAL

#### 1.1 PAYMENT PROCEDURES

- A. Submit a Schedule of Values at least **seven (7)** days before the initial Application for Payment. Break down the Contract Sum into at least one line item for each Specification Section in the Project Manual table of contents. Coordinate the schedule of values with Contractor's construction schedule.
1. Arrange schedule of values consistent with format of AIA Document G703.
  2. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
  3. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
  4. Provide separate line items in the schedule of values for initial cost of materials and for total installed value of that part of the Work.
  5. Provide a separate line item in the schedule of values for each allowance.
- B. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 forms for Applications for Payment.
1. Anticipated Application for Payment Schedule:
    - a. Application for Payment No. 01: once material is delivered to project site
    - b. Application for Payment No. 02: upon completion of installation
    - c. Application for Payment No. 03: Final payment upon completion of punch list, receipt of all close-out documents and completion of owner training
- C. Submit **three (3)** copies of each application for payment according to the schedule established in Owner/Contractor Agreement.
1. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor.
  2. With each Application for Payment, Contractor shall include the Contractor's waiver of lien for the full amount and partial waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

3. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
  - a. Include insurance certificates, proof that taxes, fees, and similar obligations were paid, and evidence that claims have been settled.
  - b. Include affidavit of payment of debts and claims on AIA Document G706.
  - c. Include affidavit of release of liens on AIA Document G706A.
  - d. Include consent of surety to final payment on AIA Document G707.
  
4. Certified Payroll Statements: The Contractor shall submit Certified Payroll Statements pursuant to Illinois Law-Public Act 94-0515 with each payment application. The *Certified Transcript of Payroll* statement forms are available through the Illinois Department of Labor website:  
<http://www.state.il.us/agency/idol/forms/pdfs/IL452CM02.pdf>.  
Certified payroll statements are required from the Contractor and each Subcontractor. The statements are to include the time period of the payment application. Payment Applications will not be processed without accompanying Certified Payroll Statements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2000

## SECTION 01 2500 - SUBSTITUTION PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUBSTITUTION PROCEDURES

- A. Substitutions include changes in products, materials, equipment, and methods of Contractor.
- B. Substitution Requests: Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles. Substitutions will NOT be considered after bidding.
  - 1. Substitution Request Form: Use facsimile of form provided in the Project Manual.
  - 2. **Submit requests by noon on Friday, May 28, 2021.**
  - 3. Identify product to be replaced and show compliance with requirements for substitutions. **Include a detailed comparison of significant qualities of proposed substitution with those of the Work specified**, a list of changes needed to other parts of the Work required to accommodate proposed substitution, and any proposed changes in the Contract Sum or the Contract Time should the substitution be accepted.
  - 4. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. **Indicate deviations, if any, from the Work specified.**
    - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

- e. Samples, where applicable or requested:
    - 1) All samples shall be clearly labeled with product information and Vendor contact information.
  - f. Certificates and qualification data, where applicable or requested.
  - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
  - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
  - i. Research reports evidencing compliance with building code in effect for Project.
  - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - k. Cost information, including a proposal of change, if any, in the Contract Sum.
  - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
  - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
- C. Architect will review proposed substitutions and notify Contractor of their acceptance or rejection via Addendum. If necessary, Architect will request additional information or documentation for evaluation.
- 1. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.
- D. Do not submit unapproved substitutions on Shop Drawings or other submittals.



PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2500

# SUBSTITUTION REQUEST FORM

**Project:** Satellite Jail HVAC Replacement Project

**Request No.:**

**Date:**

**Location (provide room number(s):**

**Name of Material, Product or Equipment item specified:**

**Name of Material, Product or Equipment item submitted as substitution:**

**Specification Section:**

**Qualities that differ from specified product or system:**

**Name of Manufacturer / Fabricator:**

**Address**

**City, State and Zip**

**Phone:**

Name of Vendor / Supplier Requesting Change	Address	Contact Name	Phone:

**Reason for requesting substitution request:**

**Substitution affects other materials or systems, such as dimensional revisions, redesign of structure or modifications to other work:**

\_\_\_\_\_ NO

\_\_\_\_\_ YES; describe requirements:

**If substitution requires modifications to dimensions indicated on drawings, are such modifications clearly indicated on attached data?**

\_\_\_\_\_ YES

\_\_\_\_\_ NO; if NO, explain:

**Substitution has an affect on Construction Schedule:**

\_\_\_\_\_ NO

\_\_\_\_\_ YES; describe affect on schedule:

**Savings or Credit to Contract Amount for accepting substitute:**

\_\_\_\_\_ Dollars (\$\_\_\_\_\_).

Note: Show bid amount in both words and figures.

**The attached data is furnished herewith for evaluation of the substitution:**

\_\_\_\_\_ Product Data \_\_\_\_\_ Drawings \_\_\_\_\_ Samples \_\_\_\_\_ Tests \_\_\_\_\_ Reports

\_\_\_\_\_ Other Information; describe:

**The undersigned hereby certifies:**

1. The proposed substitution has been fully investigated and is equal or superior to specified product.
2. The same or better warranty will be furnished for proposed substitution as for specified material, product or equipment.
3. All changes in the work resulting from the use of this substitution, if approved, will be coordinated and completed in all respects and all costs, including, but not limited to, those for additional services rendered by the Owner are the responsibility for this Contractor at no additional cost to the Contract.

\_\_\_\_\_  
Contractor

\_\_\_\_\_  
Signed by

\_\_\_\_\_  
Address

\_\_\_\_\_  
City, State and Zip

END OF SUBSTITUTION FORM 01 2500a

## SECTION 01 2600 - CONTRACT MODIFICATION PROCEDURES

### PART 1 - GENERAL

#### 1.1 CONTRACT MODIFICATION PROCEDURES

- A. Design Team will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.
- B. Owner-Initiated Proposal Requests: Design Team will issue a detailed description of proposed changes in the Work.
  - 1. Proposal Requests are not instructions either to stop work in progress or to execute the proposed change.
  - 2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time.
- C. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Design Team.
- D. On Owner's approval of a Proposal Request, Design Team will issue a Change Order for signatures of Owner and Contractor, for all changes to the Contract Sum or the Contract Time.
- E. Design Team may issue a Construction Change Directive. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- F. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2600

## SECTION 01 3000 - ADMINISTRATIVE REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 PROJECT MANAGEMENT AND COORDINATION

- A. Subcontract List: Submit a written summary identifying individuals or firms proposed for each portion of the Work.
- B. Key Personnel Names: Within ten (10) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. List e-mail addresses and telephone numbers.
- C. Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work.
- D. Requests for Information (RFIs): On discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI. Use forms acceptable to Design Team and Owner.
- E. Schedule and conduct (2) progress meetings at Project site, coordinated with the Design Team and Owner. **Notify Owner of meeting dates and times.** Require attendance of each subcontractor or other entity concerned with current progress or involved in planning, coordination, or performance of future activities.

#### 1.2 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 1. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  - 2. Submit two copies of each action submittal. Design Team will return one copy.
  - 3. Submit one copy of each informational submittal. Design Team will not return copies.
  - 4. Design Team will discard submittals received from sources other than Contractor.

- B. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
  - 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  - 2. Name file with unique identifier, including project identifier, Specification Section number, and revision identifier.
  - 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Design Team.
- C. Identify options requiring selection by Design Team.
- D. Identify deviations from the Contract Documents on submittals.
- E. Contractor's Construction Schedule Submittal Procedure:
  - 1. Submit required submittals in the following format:
    - a. PDF electronic file.
  - 2. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.

## PART 2 - PRODUCTS

### 2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections.
  - 1. Submit electronic submittals via email as PDF electronic files to Shannon Hicks at GHR Engineers and Associates, Inc.: [shicks@ghrinc.com](mailto:shicks@ghrinc.com).
    - a. Design Team will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

### 2.2 ACTION SUBMITTALS

- A. Submit two paper copies of each submittal unless otherwise indicated. Design Team will return one copy.

- B. Product Data: Mark each copy to show applicable products and options. Include the following:
  - 1. Manufacturer's written recommendations, product specifications, and installation instructions.
  - 2. Wiring diagrams showing factory-installed wiring.
  - 3. Printed performance curves and operational range diagrams.
  - 4. Testing by recognized testing agency.
  - 5. Compliance with specified standards and requirements.
  
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data. Submit on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches. Include the following:
  - 1. Dimensions and identification of products.
  - 2. Fabrication and installation drawings and roughing-in and setting diagrams.
  - 3. Wiring diagrams showing field-installed wiring.
  - 4. Notation of coordination requirements.
  - 5. Notation of dimensions established by field measurement.

## 2.3 INFORMATIONAL SUBMITTALS

- A. Informational Submittals: Submit one paper copy of each submittal unless otherwise indicated. Design Team will not return copies.
  
- B. Qualification Data: Include lists of completed projects with project names and addresses, names and addresses of Design Team and owners, and other information specified.
  
- C. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

## PART 3 - EXECUTION

### 3.1 SUBMITTAL REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Design Team.



- B. Design Team will review each action submittal, make marks to indicate corrections or modifications required, will stamp each submittal with an action stamp, and will mark stamp appropriately to indicate action.
- C. Informational Submittals: Design Team will review each submittal and will not return it, or will return it if it does not comply with requirements. Design Team will forward each submittal to appropriate party.
- D. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01 3000

## SECTION 01 4000 - QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SECTION REQUIREMENTS

- A. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
- B. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements, comply with the most stringent requirement. Refer uncertainties to Design Team for a decision.
- C. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum. The actual installation may exceed the minimum within reasonable limits. Indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Design Team for a decision.
- D. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
  - 1. Date of issue.
  - 2. Project title and number.
  - 3. Name, address, and telephone number of testing agency.
  - 4. Dates and locations of samples and tests or inspections.
  - 5. Names of individuals making tests and inspections.
  - 6. Description of the Work and test and inspection method.
  - 7. Identification of product and Specification Section.
  - 8. Complete test or inspection data.
  - 9. Test and inspection results and an interpretation of test results.
  - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  - 12. Name and signature of laboratory inspector.
  - 13. Recommendations on retesting and reinspecting.

- E. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, notices, receipts for fee payments, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.
- F. Testing Agency Qualifications: An independent agency with the experience and capability to conduct testing and inspecting indicated; and where required by authorities having jurisdiction, that is acceptable to authorities.
- G. Retesting / Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced work that failed to comply with the Contract Documents.
- H. Testing Agency Responsibilities: Cooperate with Design Team and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
  - 1. Notify Design Team and Contractor of irregularities or deficiencies in the work observed during performance of its services.
  - 2. Do not release, revoke, alter or increase requirements of the Contract Documents or approve or accept any portion of the work.
  - 3. Do not perform any duties of Contractor.
- I. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
  - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- J. Tests and Inspections: Owner will engage a qualified inspector to conduct inspections required by authorities having jurisdiction.

PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 REPAIR AND PROTECTION

- A. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.
- B. Contractor will maintain a safe work site at all times. When the project is complete, Contractor shall return the work site and the surrounding areas to the same condition as they were prior to the beginning of the project.

END OF SECTION 01 4000

## SECTION 01 6000 - PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SECTION REQUIREMENTS

- A. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
- B. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced.
  - 1. Show compliance with requirements for comparable product requests.
  - 2. Design Team will review the proposed product and notify Contractor of its acceptance or rejection.
- C. Basis-of-Design Product Specification Submittal: Show compliance with requirements.
- D. Compatibility of Options: If Contractor is given option of selecting between two or more products, select product compatible with products previously selected.
- E. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
  - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Deliver products to Project site in manufacturer's original sealed container or packaging, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 3. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
  - 4. Store materials in a manner that will not endanger Project structure.
  - 5. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
- F. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

- A. Provide products that comply with the Contract Documents, are undamaged, and, unless otherwise indicated, are new at the time of installation.
  - 1. Provide products complete with accessories, trim, finish, and other devices and components needed for a complete installation and the intended use and effect.
  - 2. Where products are accompanied by the term "as selected," Owner will make selection.
  - 3. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. Where the following headings are used to list products or manufacturers, the Contractor's options for product selection are as follows:
  - 1. Products:
    - a. Where requirements include "one of the following," provide one of the products listed that complies with requirements.
    - b. Where requirements do not include "one of the following," provide one of the products listed that complies with requirements or a comparable product.
  - 2. Manufacturers:
    - a. Where requirements include "one of the following," provide a product that complies with requirements by one of the listed manufacturers.
    - b. Where requirements do not include "one of the following," provide a product that complies with requirements by one of the listed manufacturers or another manufacturer.
  - 3. Basis-of-Design Product: Provide the product named, or indicated on the Drawings, or a comparable product by one of the listed manufacturers.

### 2.2 COMPARABLE PRODUCTS

- A. Design Team will consider Contractor's request for comparable product in advance of Bidding only when the following conditions are satisfied:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications.
3. List of similar installations for completed projects, if requested.
4. Samples, where applicable.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 6000

## SECTION 01 7000 - EXECUTION AND CLOSEOUT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 EXECUTION REQUIREMENTS

##### A. Cutting and Patching:

1. Structural Elements: When cutting and patching structural elements, notify Design Team of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
3. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities.

##### B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

#### 1.2 CLOSEOUT SUBMITTALS

- A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- B. Certified List of Incomplete Items: Final submittal at Final Completion.
- C. Operation and Maintenance Data: Submit two (2) copies of manual.
- D. PDF Electronic File: Assemble manual into a composite electronically indexed file. Submit two (2) copies on digital media.
- E. Record Product Data: Submit two (2) paper copies and annotated PDF electronic files and directories of each submittal.



### 1.3 SUBSTANTIAL COMPLETION PROCEDURES

- A. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
- B. Submittals Prior to Substantial Completion: Before requesting Substantial Completion inspection, complete the following:
  - 1. Submit closeout submittals specified in other sections, including project record documents, operation and maintenance manuals, similar final record information, warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 2. Submit maintenance material submittals specified in other sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner.
  - 3. Submit test/adjust/balance records.
- C. Procedures Prior to Substantial Completion: Before requesting Substantial Completion inspection, complete the following:
  - 1. Complete startup and testing of systems and equipment.
  - 2. Perform preventive maintenance on equipment used prior to Substantial Completion.
  - 3. Remove temporary facilities and controls.
  - 4. Complete final cleaning requirements, including touchup painting.
  - 5. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will proceed with inspection or advise Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will advise Contractor of items that must be completed or corrected before certificate will be issued.

### 1.4 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting inspection for determining final completion, complete the following:
  - 1. Submit a final Application for Payment.

2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved.
- B. Submit a written request for final inspection for acceptance. On receipt of request, Design Team will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare final Certificate for Payment after inspection or will advise Contractor of items that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
- B. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

### 2.2 OPERATION AND MAINTENANCE DOCUMENTATION

- A. Directory: Prepare a single, comprehensive directory of operation and maintenance data and materials, listing items and their location to facilitate ready access to desired information.
- B. Organization: Unless otherwise indicated, organize manual into separate sections for each system and subsystem, and separate sections for each piece of equipment not part of a system.

1. Dividers: Provide heavy paper dividers with celluloid-covered tabs for each separate Section. Mark each tab to indicate contents. Provide a typed description of the product and major parts of equipment included in the Section on each divider.
- C. Organize data into three-ring binders with identification on front and spine of each binder, and envelopes for folded drawings. Identify each binder on the front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL", Project title or name, year and subject matter covered. Indicate volume number for multiple volume sets of manuals. Include the following:
1. Manufacturer's operation and maintenance documentation.
  2. Maintenance and service schedules.
  3. Maintenance service contracts. Include name and telephone number of service agent.
  4. Emergency instructions.
  5. Spare parts list and local sources of maintenance materials.
  6. Wiring diagrams.
  7. Copies of warranties. Include procedures to follow and required notifications for warranty claims

### 2.3 RECORD DRAWINGS

- A. Record Prints: Maintain a set of prints of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued. Mark to show actual installation where installation varies from that shown originally. Accurately record information in an acceptable drawing technique.
1. Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings.
1. Format: Annotated PDF electronic file.

## PART 3 - EXECUTION

### 3.1 EXAMINATION AND PREPARATION

- A. Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Verify compatibility with and suitability of substrates.
  - 2. Examine roughing-in for mechanical and electrical systems.
  - 3. Examine walls, floors, and roofs for suitable conditions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Take field measurements as required to fit the Work properly. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication.
- D. Verify space requirements and dimensions of items shown diagrammatically on Drawings.

### 3.2 CONSTRUCTION LAYOUT

- A. Before proceeding to lay out the Work, verify layout information shown on Drawings.

### 3.3 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Conceal wiring in finished areas unless otherwise indicated.
  - 3. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations.
- C. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

- D. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed.
- E. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place. Where size and type of attachments are not indicated, verify size and type required for load conditions.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Owner.
- F. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- G. Use products, cleaners, and installation materials that are not considered hazardous.

#### 3.4 CUTTING AND PATCHING

- A. Provide temporary support of work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- D. Cutting: Cut in-place construction using methods least likely to damage elements retained or adjoining construction.
  - 1. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
- E. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
  - 1. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction in a manner that will minimize evidence of patching and refinishing.

2. Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance.
3. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

### 3.5 CLEANING

- A. Clean Project site and work areas daily, including common areas. Dispose of materials lawfully.
  1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
  3. Remove debris from concealed spaces before enclosing the space.
- B. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion:
  1. Clean Project site and grounds, in areas disturbed by construction activities. Sweep paved areas; remove stains, spills, and foreign deposits. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
  2. Sweep paved areas broom clean. Remove spills, stains, and other foreign deposits.
  3. Remove labels that are not permanent.
  4. Clean transparent materials, including mirrors. Remove excess glazing compounds.
  5. Clean exposed finishes to a dust-free condition, free of stains, films, and foreign substances. Sweep concrete floors broom clean.
  6. Vacuum carpeted surfaces.
  7. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and foreign substances. Clean plumbing fixtures. Clean light fixtures, lamps, globes, and reflectors.

### 3.6 OPERATION AND MAINTENANCE MANUAL PREPARATION

- A. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

- B. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
  - 1. Prepare supplementary text if manufacturers' standard printed data are unavailable and where the information is necessary for proper operation and maintenance of equipment or systems.
- C. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams.

### 3.7 DEMONSTRATION AND TRAINING

- A. Contractor to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system. Include a detailed review of the following:
  - 1. Include instruction for basis of system design and operational requirements, review of documentation, emergency procedures, operations, adjustments, troubleshooting, maintenance, and repairs.
- B. Contractor shall train Owner's teaching faculty on the online monitoring functionality of new system.

END OF SECTION 01 7000

## SECTION 01 7419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

### PART 1 - GENERAL (Not Used)

### PART 2 - PRODUCTS (Not Used)

### PART 3 - EXECUTION

#### 3.1 PLAN IMPLEMENTATION

- A. General: Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
  - 1. Review locations established for recycling and disposal.

#### 3.2 RECYCLING WASTE

- A. Packaging:
  - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - 2. Polystyrene Packaging: Separate and bag materials.
  - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:
  - 1. Sort and stack reusable members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
  - 2. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  - 3. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- C. Metals: Separate metals by type.



### 3.3 DISPOSAL OF WASTE

- A. Except for items or materials to be recycled or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
- B. Recycle recyclable materials off-site.
- C. Do not burn waste materials.

END OF SECTION 01 7419

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Transition fittings.
  - 3. Dielectric fittings.
  - 4. Mechanical sleeve seals.
  - 5. Sleeves.
  - 6. Escutcheons.
  - 7. Grout.
  - 8. Equipment installation requirements common to equipment sections.
  - 9. Painting and finishing.
  - 10. Concrete bases.
  - 11. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-dieneterpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

#### 1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

#### 1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

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

- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

## 1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

## 1.8 HAZARDOUS MATERIALS

- A. No asbestos-containing materials may be used anywhere on this project.
- B. No lead-based materials may be used anywhere on this project.

## 1.9 LOCATION OF EQUIPMENT

- A. The approximate location of all equipment and pipe is shown on the drawings.
- B. Architect / Engineer may change the location of any equipment or piping 5' in any direction without these changes being made the subject of an extra charge provided such changes are made before final installation.
- C. Where offsets in piping, additional fittings, necessary drains, minor valves, traps, devices, etc., are required to complete the installation, to clear obstructions or the work of other Contractors or for the proper operation of the system, these shall be deemed to be included in the Contract and shall be furnished and installed complete by the Contractor at no additional charge.

## PART 2 - PRODUCTS

### 2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

## 2.2 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining Plastic Piping:
  - 1. CPVC Piping: ASTM F 493.
  - 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

## 2.3 TRANSITION FITTINGS

- A. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
- B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

- C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

## 2.4 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

- B. Insulating Material: Suitable for system fluid, pressure, and temperature.

- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

- 1. Manufacturers:

- a. Capitol Manufacturing Co.
- b. Central Plastics Company.
- c. Eclipse, Inc.
- d. Epco Sales, Inc.
- e. Hart Industries, International, Inc.
- f. Watts Industries, Inc.; Water Products Div.
- g. Zurn Industries, Inc.; Wilkins Div.

- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

- 1. Manufacturers:

- a. Capitol Manufacturing Co.
- b. Central Plastics Company.
- c. Epco Sales, Inc.
- d. Watts Industries, Inc.; Water Products Div.

- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

- 1. Manufacturers:

- a. Advance Products & Systems, Inc.
- b. Calpico, Inc.
- c. Central Plastics Company.
- d. Pipeline Seal and Insulator, Inc.

- 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
  - 1. Manufacturers:
    - a. Calpico, Inc.
    - b. Lochinvar Corp.
  
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
  - 1. Manufacturers:
    - a. Perfection Corp.
    - b. Precision Plumbing Products, Inc.
    - c. Sioux Chief Manufacturing Co., Inc.
    - d. Victaulic Co. of America.

## 2.5 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
  - 1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
  
  - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 3. Pressure Plates: Stainless steel. Include two for each sealing element.
  - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.6 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.

## 2.7 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated and rough brass.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated and rough brass.
- E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

## 2.8 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS



- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
  - 1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
  - 2. Insulated Piping: One-piece, stamped-steel type with spring clips.
  - 3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
  - 4. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
  - 5. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
  - 6. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
  - 7. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
  - 8. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.

- O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
    - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
    - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
      - 1) Seal space outside of sleeve fittings with grout.
  4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches in diameter.
  2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
  3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Through-Penetration Firestop Systems" for materials.
- S. Verify final equipment locations for roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
  4. PVC Nonpressure Piping: Join according to ASTM D 2855.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End Pipe and Fittings: Use butt fusion.
  2. Plain-End Pipe and Socket Fittings: Use socket fusion.

### 3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### 3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

### 3.5 SPACE PREFERENCE

- A. Coordinate the location and elevation of all work. Verify with all other Contractors to avoid conflicts.

- B. In case of conflicts, the following installation priorities shall prevail:
  - 1. Recessed electric fixtures
  - 2. Sanitary / vent and storm drainage
  - 3. Closed loop water piping
  - 4. Low pressure ductwork
  - 5. Domestic water lines
  - 6. Sprinkler lines
  - 7. Electric conduits
- C. No other work shall have preference over plumbing lines below fixtures.
- D. No other work shall have preference over bus duct or conduit above or below electric switchgear and panels.
- E. No piping conveying fluids shall be installed directly over electrical or elevator equipment.

### 3.6 PAINTING

- A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.7 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  - 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03.

### 3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

### 3.9 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END 23 0500

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. HVAC Contractor: Provide and install heating, ventilating and air conditioning systems as shown on the drawings and as specified herein. Work includes but is not limited to the following:

- a. Demolition
- b. Hot water piping
- c. Chilled water piping
- d. Vent piping
- e. Drain piping
- f. Water specialties
- g. Expansion tanks
- h. Expansion joints
- i. Valves and fittings
- j. Refrigerant piping and accessories
- k. Circulating pumps
- l. Water treatment
- m. Flex connections
- n. Testing
- o. Cleaning

B. Work Not Included

1. Materials, equipment or final connections to items of equipment specified or noted on the drawings to be furnished or executed under another contract.

1.2 RELATED WORK

A. Specified elsewhere:

1. Sections: Architectural / Structural and General Work
2. Section 22 00 20 - Mechanical Insulation
3. Division 23 - Mechanical Systems

1.3 QUALITY ASSURANCE

- A. Use only new material and apparatus of the specified design and manufacturer. Furnish all materials in accordance with latest ANSI, AWWA, ASTM, NFPA, AGA, ASME, IBR, UL standards and other applicable standards or codes.

## 1.4 SUBMITTALS

- A. See Architectural Sections for requirements.

## PART 2 - PRODUCTS

### 2.1 PIPING DATA - HEATING AND COOLING

- A. Install all vents for all of the safety valves, pressure reducing valves and all equipment in this contract requiring such vents. Connect safety valves to vent lines with an open connection made by sliding a larger pipe over the stub from exhaust valve. Unless otherwise shown on the drawings, extend vents through roof and where possible pitch all vent piping to drain into a condensate receiver. Flash all vents through roof with a 12" high roof jack fabricated of 6 lb sheet lead and extend 12" from side of vent in all directions on roof. Provide counter-flashing rain skirt clamped around pipe over top of roof jack.
- B. Pipe and fittings for the various systems shall be as follows:
- C. Hot Water Piping
  - 1. All hot water piping shall be standard weight Schedule 40 black steel pipe with all joints 2½" and larger welded or flanged. Fittings shall be standard weight screwed cast iron or butt-type welding. Accomplish all reductions in horizontal supply pipe size with eccentric reducing fittings installed with top level.
  - 2. At HVAC Contractor's option, type L hard drawn copper tubing with wrought copper fittings may be used in sizes 2-1/2" and smaller. Solder all joints with 95-5 tin-antimony solder. Use dielectric unions at all connections to dissimilar materials.
- D. Chilled Water Piping
  - 1. All chilled water piping shall be standard weight Schedule 40 black steel pipe with all joints 2½" and larger welded or flanged. Fittings shall be standard weight screwed cast iron or butt-type welding. Accomplish all reductions in horizontal supply pipe size with eccentric reducing fittings installed with top level.
  - 2. At HVAC Contractor's option type L hard drawn copper tubing with wrought copper fittings may be used in sizes 2" and smaller. Solder all joints with 95-5 tin-antimony solder. Use dielectric unions at all connections to dissimilar materials.
- E. Vent Piping
  - 1. All vent piping shall be Schedule 40 black steel, with all joints welded. Fittings shall be standard weight butt-type welding of same material as piping.
- F. Drain Piping
  - 1. All above grade condensate drain piping shall be schedule 40 black steel or type DWV copper piping with copper drainage fittings. Minimum size shall be 1½". Provide cleanout plug at all points where piping changes direction.



G. Make-Up Water

1. All final connections of make-up water from the domestic water system shall be of materials as specified in the Plumbing Section - 22 10 10 of these Specifications. Final connections shall be by HVAC Contractor.

2.2 HOT WATER SPECIALTIES

- A. Manual air vents in pipelines shall be constructed of short vertical sections of line size piping to form air chamber. See detail on drawings. Provide vents in all high points in piping and at the top of each pipe riser.
- B. Manual air vents at fin tube heating elements, cabinet unit heaters shall be brass needle valves, screwdriver operated (Dole No. 9).
- C. Automatic air vents shall be chrome-plated brass, float type, suitable for maximum system pressure.
- D. Acceptable Manufacturers
  1. Dunham-Bush
  2. Dole
  3. Sarco

2.3 PIPING SPECIALTIES

- A. Provide and install pressure/temperature measuring glands to allow pressure and temperature readings to be taken. Units shall be suitable for 500 psig with temperatures ranging from 40 to 275°F. Units shall utilize nordel seals. (Minister and Associates, 314 New Salem Street, Park Forest, Illinois 60466 (708) 481-6090). Sisco P/T plugs: MESA Inc. (314) 644-6060. Test Plugs: H.O. Trerice Co. TU: HCI 800-313-4822
- B. Provide at the following locations:
  1. Reheat coils (including in VAV boxes)
  2. Fan coils and blower coils
  3. Chilled water coils
  4. Hot water heating coils

2.4 DIAPHRAGM-TYPE EXPANSION TANKS

- A. Provide and install ASME-stamped expansion tanks suitable for 125 psig working pressure and 240°F operating temperature in HW and CHW systems. Tank shall be primed steel with heavy duty butyl replaceable bladder. Tank shall be furnished with mounting saddles, system tapping and charging valve.
- B. Contractor shall note mounting position of tanks and order tanks to suit.
- C. Tank shall be air precharged to the initial fill pressure of the system.

- D. Mount vertical tanks on 3-1/2" poured concrete housekeeping pad. Pad by HVAC Contractor.
- E. Pipe tanks per manufacturer's written recommendations. Note need for anti-siphon loops in heating application.
- F. Acceptable Manufacturers
  - 1. Amtrol
  - 2. Thrush
  - 3. Taco
  - 4. Armstrong
  - 5. B&G
- G. Forward shop drawing submittals to Architect / Engineer for review.

## 2.5 AIR SEPARATOR

- A. Provide a line-size centrifugal air separator in the hot water and chilled water systems to provide for removal of air. The unit shall be designed to separate the water and air by centrifugal force and shall have flanged inlet and outlet connections and a top center tapping for the air eliminator connection to the expansion tanks.
- B. Acceptable Manufacturers
  - 1. Bell & Gossett
  - 2. Taco
  - 3. Thrush or Armstrong
- C. Forward shop drawing submittals to the Architect / Engineer for review.

## 2.6 WATER PRESSURE REDUCING VALVE

- A. Provide a pressure reducing valve on the cold water make up line to the hot water heating (and chilled water) system. Outlet pressure shall be adjustable and shall be set at 15 psi. The valve shall control the pressure on the heating and chilled water systems, shall be preceded by a gate valve, and shall have a pressure gauge installed after it.
- B. Acceptable Manufacturers
  - 1. Bell and Gossett
  - 2. Taco
  - 3. Thrush
  - 4. Armstrong

2.7 VALVES - HEATING

- A. Use valves for all piping systems as scheduled below and locate in main and branch lines and at equipment where shown on the drawings for operation and maintenance of the system.
- B. All valves shall be line-sized (same size as line in which they are installed). Exceptions to this requirement may be made for:
  - 1. Control valves.
  - 2. Balancing valves.
  - 3. Triple duty valves.
- C. Install a screwed or flanged union between each valve, within 6" of the valve and any equipment or apparatus which may require service or removal. Arrange piping and valves in such a manner that no piping need be disturbed, except branch to individual equipment or apparatus, when removing or servicing.
- D. All valves shall be tight in operation and if any leaks are found, they shall be repacked with best grade of packing to suit service.
- E. All risers shall be valved. Branch runouts shall be valved where indicated on the drawings.
- F. All bypass valves shall be globe or butterfly type.
- G. All shut-off valves 3" and larger shall be either gate valves or butterfly valves.
- H. Gate Valves
  - 1. General Shut-off Service - 2" and smaller up to 125 psig
    - a. Gate Valves for use in general shut-off service of steam, condensate, water, and oil shall be 125 SWP, 300 WOG, bronze threaded end, rising stem, solid wedge, union bonnet and gland packed.

MANUFACTURER	VALVE NUMBER
Powell	2714
Milwaukee	1151
  - 2. General Shut-off Service - 2½" and larger up to 125 psig
    - a. Gate Valves shall be 125 SWP, 200 WOG, cast iron, flanged end bronze trim, rising stem, OS & Y and gland packed.

MANUFACTURER	VALVE NUMBER
Powell	1793
Milwaukee	F-2885-M

3. General Shut-off Service - 2" and smaller over 125 psig
  - a. Gate Valves shall be 200 SWP, 400 WOG, bronze threaded end, rising stem, solid wedge, union bonnet and gland packed.
 

MANUFACTURER	VALVE NUMBER
Powell	2375
Milwaukee	1153

4. General Shut-off Service - 2" and smaller up to 150 psig
  - a. Gate Valves shall be 200 SWP, 400 WOG, bronze threaded end, rising stem, solid wedge, stainless or monel seat ring, union bonnet and gland packed.
 

MANUFACTURER	VALVE NUMBER
Powell	2375
Milwaukee	1153

I. Globe Valves

1. General Modulating Service - 2" and smaller up to 125 psig
  - a. Globe Valves for use in general modulating service and steam, condensate, water and oil shall be 150 SWP, 300 WOG, bronze threaded end, union bonnet and gland packed disc material shall be compatible to line media.
 

MANUFACTURER	VALVE NUMBER
Powell	150-A
Milwaukee	590
2. General Modulating Service - 2½" and larger up to 125 psig
  - a. Globe Valves shall be 125 SWP, 200 WOG, flanged end, cast iron, OS & Y, rising stem and bronze trim.

MANUFACTURER	VALVE NUMBER
Powell	241
Velan	0074 C Series

3. General Modulating Service - 2" and smaller over 125 psig
  - a. Globe Valves shall be 200 SWP, 400 WOG, bronze trim, threaded end, union bonnet, gland packed with hard faced stainless seat and disc.
 

MANUFACTURER	VALVE NUMBER
Powell	110
Milwaukee	592A

J. Check Valves

1. General Service - 2" and smaller up to 125 psig

- a. Check Valves in all piping of steam, condensate, air, gas, water and oil shall be 150 SWP, 300 WOG, bronze threaded end, horizontal swing check design, composition disc compatible to line media and be so designed that it can be used in either the horizontal or vertical position.

MANUFACTURER	VALVE NUMBER
Powell	596
Milwaukee	510

2. General Service - 2½" and larger up to 125 psig

- a. Check Valves shall be 125 SWP, 200 WOG, flanged end, cast iron, swing check and bronze trim.

MANUFACTURER	VALVE NUMBER
Powell	559
Milwaukee	F-2974-M

3. Check Valves for Pump Discharge - 6" and smaller up to 125 psig

MANUFACTURER	VALVE NUMBER
Clow	329
CPV	10B
Mueller (Grinnell)	101-MAP
Durable	WLC Series

4. Check Valves for Pump Discharge - 8" and larger up to 125 psig

MANUFACTURER	VALVE NUMBER
Clow	375
CPV	20B
Mueller (Grinnell)	105-MAP
Durable	GLC Series
Conbraco Industries, Inc.	
Metaflex Company	

5. Check Valves for Pump Discharge over 125 psig - All Sizes

MANUFACTURER	VALVE NUMBER
Clow	636
CPV	21B
Mueller (Grinnell)	107-MAP
Durable	GLC Series

K. Butterfly Valves

1. Butterfly Valves for General Shut-Off Service - 2½" and larger up to 125 psig for use with chilled water and condenser water only.

- a. Butterfly Valves shall be of the double-tap, lug-style, cast iron body, with ductile iron discs, seats and seals, type 316, stainless steel shafts, secondary shaft seals and nonmetallic shaft bearings, shall be of EPDM for service to 250°F. Valves shall comply to API 609 and MSS-SP67 for use between ANSI class 125 iron and / or ANSI class 150 steel flange.

Operator shafts shall be extended to allow clearance for insulation - 6" and smaller shall be lever operated - 8" and larger shall be gear and handwheel operated. All valves shall seal bubble-tight up to 125 psig.

b. Install with shafts in horizontal position.

MANUFACTURER	VALVE NUMBER
Keystone	AR2
Grinnell	
Nibco	HPR with EPDM liner (LD-2000)
Watts	BF 03 with EPDM seat
DeZurik	Fig. 660 with EPDM liner
Milwaukee	M-Series

L. Balancing Valves

1. General Shut-off and Balancing Service for listed equipment - 1/2" - 2" up to 125 psig.

a. The following valves shall be used in general shut-off and balancing service in all run-outs to convectors, unit heaters, radiation, fan coil units, unit ventilators, heaters, induction units, reheat coils, manual control convectors and injection nozzles. Valves shall be capable of a Bubble-Tight Shut Off.

b. All return branches in hot and chilled water lines shall be furnished with balancing valve.

c. Provide preformed insulation boots for all balancing valves. Boots shall be provided by valve manufacturer.

d. These valves shall have infinite setting devices to prevent reopening past present balancing point when valves are used for shut-off purposes. They shall be threaded end to match piping. Provide key operator and balancing stop.

e. Valves shall have flow measurement ports to allow balancing. Make sure valves fit in intended space before ordering.

MANUFACTURER	VALVE NUMBER
Armstrong	CBV (with flow measurement ports)
Wheatley	GS (with flow measurement ports)
Tour and Anderson	TA (with flow measurement ports)
Griswold Controls	

2. Pipeline shut-off and balancing service for air handling units, pumps and other listed equipment - 2-1/2" - 6" up to 125 psig.

a. Use also for large piping, air handlers and larger flow.

b. Double tap lug style bodies shall be used. These valves shall be capable of tight shut-off when in the closed position. Valves shall be complete with locking mechanism that can be set at a balance point so that the valves may be closed and opened, but not opened beyond the preset balance point. Valves shall be furnished with an indicator from 0 to 100% of valve opening. Valve connections shall conform to ANSI standards.

- c. Operator shafts shall be extended to allow insulation to cover the valves or valve manufacturer shall provide preformed insulation boots to match valves.
- d. Valves shall have flow measurement ports to allow balancing.
 

MANUFACTURER	VALVE NUMBER
Armstrong	CBV (with flow measurement ports)
Wheatley	GS (with flow measurement ports)
Tour and Anderson	TA (with flow measurement ports)

M. Ball Valves

- 1. Ball valves may be used in lieu of gate valves for hot water or chilled water. Ball valves with memory stop may not be used in lieu of balancing valves.
- 2. General Shut-off Service - 2" and smaller up to 125 psig

- a. Ball valves shall be 150 SWP, 400 WOG, full port, two piece bronze threaded or soldered end, blowout proof stem, stainless steel ball, TFE seat rings, and lever handle - fed. spec. MSS-SP-110. All ball valves shall have extended valve stems to allow full thickness insulation to be installed.

MANUFACTURER	VALVE NUMBER
Apollo	70-100-01
Crane	2180
Hammond	805
Watts Regulator	B6000
Jamesbury	351

- 3. General Shut-off Service - 2" and Smaller up to 150 psig
  - a. Ball valves shall be 150 SWP, 400 WOG, full port, two or three piece bronze threaded or soldered end, blowout proof stem, stainless steel ball, TFE seat ring, full port lever handle - Fed. MSS-SP-110. All ball valves shall have extended valve stems to allow full thickness insulation to be installed.

MANUFACTURER	VALVE NUMBER
Apollo	77-140-01
Apollo (3pc)	82-140-01
Grinnell (2pc)	3700
Grinnell (3pc)	3810
Nibco (3pc)	590 or 595
Pittsburgh Brass	SS-B
Worcester	411T

OR

2.8 PUMP DISCHARGE TRIPLE DUTY VALVES UP TO 125 PSIG - 2" THROUGH 8"

- A. Valves shall be same manufacturer as related pumps. These valves shall be selected for between 3 feet and 5 feet of pressure drop across a wide-open valve at design flow (this may not necessarily yield line sized valve).

MANUFACTURER	VALVE NUMBER
Armstrong	FTA
Bell and Gossett	Triple Duty
Taco	360 series
Thrush	TD series

2.9 DRAIN AND PURGE VALVES

- A. Hose end valves for draining, purging and strainer blow-offs shall not be used. Provide and install full port ball valves with brass adaptor and brass cap.
- B. Forward shop drawings of all valves to Architect / Engineer for review.

2.10 PRESSURE RELIEF VALVES

- A. Pressure Relief Valves for use in all locations where shown or required by codes shall be as follows:

SERVICE	SIZE	TYPE
Boiler Safety and Steam Relief	All	Crosby-Ashton, Style HS Kunkel No. 253, semi-nozzle Consolidated, Style 1902 Watts 740
Water Relief	All	Cash Acme Type F

- B. Relief Valve capacity shall exceed maximum flow rate of upstream flow control device, pressure reducing valve, etc.
- C. Pipe relief valves full size to floor drain.
- D. Forward shop drawings of all valves to Architect / Engineer for review.

2.11 REFRIGERATION PIPING

- A. Refrigeration piping shall be Type ACR hard drawn sealed and nitrogen filled special refrigeration duty copper. Fittings shall be wrought copper streamline fittings and all elbows shall be long radius.
- B. Brazing shall be silver alloy having a minimum melting point of 1185°F. Piping shall be filled with oil pumped dry nitrogen during all brazing operations.
- C. After the system is installed and before any piping is insulated, the entire refrigeration circuit must be thoroughly leak tested. The following test procedure is recommended:



1. Remove and plug the connection points of any controls or relief valves that could be damaged by test pressure. Since the compressor is not included in the leak test, front seat both the compressor suction and discharge valves. Open the liquid line shutoff valve at the condenser, any auxiliary valves in the hot gas and liquid lines and the liquid solenoid valve(s). If the solenoid valve(s) is not equipped with a manual opening device, apply control power to the solenoid(s), opening the valve(s).
2. Connect a cylinder of oil-pumped, dry nitrogen to the frontseat port of the compressor discharge valve, if the valve is so equipped. If not, make the connection at the liquid line charging valve. Note: It is important that the pressure of the nitrogen be controlled by a reducing valve. Control is absolutely necessary because the pressure within a full cylinder of nitrogen is in excess of 2,000 psi at room temperature.
3. Set the pressure regulator on the nitrogen cylinder at 150 psig or the leak test pressure specified by local code. Open the shutoff valve on the cylinder and the valve of the manifold and charge enough nitrogen into the system to raise the pressure to 150 psig, or to the pressure required by local code. Close the manifold valve.
4. Using a rubber or rawhide mallet, tap each solder connection sufficiently hard to start any leak that might subsequently open from thermal expansion and contraction or vibration.
5. Test all pipe joints for leaks. First, check the manifold gauge. If the pressure is dropping, a major leak is present. Large leaks are detected by the sound of escaping gas. Smaller leaks are located by brushing each connection with a soap solution and watching for tell-tale bubbles. Adding a small amount of glycerine to the soap solution improves the bubbling action. Make certain that all joints are inspected thoroughly. Mark carefully any spots where leaks occur.
6. After the bubble test is completed, close the cylinder shutoff valve and bleed the test pressure through the unused part of the manifold. Repair any leaks found. Leaks are repaired by disassembling the connection, cleaning the fitting and remaking. No attempt should be made to repair a leak by simply adding brazing material.
7. After the system is assumed to be free of leaks, charge enough refrigerant through the liquid line charging valve to raise the system pressure to approximately 10 psig. Remove the refrigerant connection and charge enough nitrogen into the system to raise the test pressure to 150 psig or to the local code requirement.
8. Check all parts of the system with a halide torch or electronic leak detector. The presence of escaping refrigerant will color the flame of the halide torch green if the leak is small or a dense blue if it is large. An electronic leak detector indicates the presence of a leak by either a gauge reading, signal light or an audible sound. If any leaks are found, relieve the test pressure and repair the faulty area. Recharge the system, as described previously, and allow it to remain under pressure for 24 hours. If, at the end of this period, there is no appreciable pressure change, the system may be considered free of leaks. Note: The system pressure will change approximately 3 psig with each 10°F rise or fall in ambient temperature.
9. With the testing complete, relieve the test pressure and reconnect any valves or controls that were disconnected previously.

D. Evacuation

1. To speed the evacuation, connect the vacuum pump to as many points of the system as possible. To register the vacuum developed by the pump, a reliable vacuum gauge, such as a Zimmerli Gauge or an electronic vacuum gauge, is connected to the liquid line charging valve. The compressor valves are then cracked off of their backseats, moving the valve disc to an intermediate position between the backseat and the frontseat of the valve. Open the liquid line charging valve.
2. The vacuum pump shall be started and operated until a vacuum equivalent to 500 microns is registered by the vacuum gauge. The length of time required to achieve the 500 micron reading depends upon the size of the system and the amount of moisture within the system. Failure to reach the required vacuum reading may be due to:
  - a. Presence of a large amount of moisture. This will be removed with continued operation of the vacuum pump.
  - b. Inefficiency of the pump. Leaks within the pump or contaminated pump oil may be the cause. This may be checked by operating the pump against a vacuum gauge.
  - c. A system leak.
3. When the system has been evacuated, close the suction valve on the vacuum pump and then stop the pump. Backseat one of the compressor valves and remove the vacuum pump connection. Through this valve port charge enough oil-pumped dry nitrogen into the system to raise the pressure to atmospheric. Re-evacuate the system. Any moisture remaining in the system is absorbed by the dry nitrogen gas and is removed by the second evacuation.
4. After the 500 micron vacuum reading has been re-established, close the vacuum pump suction valve and stop the pump. Backseat the compressor valves and allow the system to stand under vacuum for a minimum of 12 hours. If the vacuum reading remains unchanged, the system is ready to receive its charge of refrigerant.

E. Charge system with proper quantity of refrigerant and lubricant.

F. Insulate suction line with foamed plastic insulation. See Specification Section 22 00 20.

G. Forward shop drawing submittals to Architect / Engineer for review. Submittal shall include complete sketch of refrigerant piping system, sizes, fittings and lengths. Indicate on sketch that manufacturer approves layout and that warranty applies. (HVAC Contractor shall note that pipe sizes and layouts on drawings are for the purpose of establishing a bid price. Final sizing and layout shall be determined and approved by refrigeration equipment manufacturer.)

H. Refrigerant purge and relief shall be piped full size in separate lines to outdoors using materials specified for refrigerant piping.

## 2.12 REFRIGERATION ACCESSORIES

- A. Furnish and install the following specialties in refrigeration piping from each unit:
1. 1 - liquid line catch-all filter-drier sized for 2 psi maximum pressure drop (with 3-valve bypass).
  2. 1 - solenoid valve with 120 volt, 60 cycle coil on each refrigerant circuit.
  3. 1 - expansion valve with external equalizer on each refrigerant circuit.
  4. 1 - liquid indicator with moisture indicating bull's-eyes in each circuit immediately upstream of expansion valve.
  5. Charging valves.
  6. Hot gas discharge muffler in each compressor circuit. Muffler shall be suitable for horizontal or vertical installation, self-draining.
- B. Acceptable Manufacturers
1. Mueller Brass Company
  2. Henry Valve Company
  3. Sporlan

## 2.13 REFRIGERANTS - GENERAL

- A. Recover and Recycle Refrigerants
1. Refrigerant used in centrifugal water chillers should be recovered and / or recycled for reuse, reprocessed (reclaimed), or properly disposed of, whenever it is removed from the equipment. Never release to atmosphere!
  2. Always determine recycle or reclaim requirements of the refrigerant before beginning recovery procedure. Obtain a chemical analysis of the refrigerant if necessary. (Questions about recovered refrigerant and acceptable refrigerant quality standards are addressed in ARI Standard 700.)
- B. Refrigerant Handling and Safety
1. Consult manufacturer's Material Safety Data Sheets (MSDS) on refrigerants being handled to understand health, safety, storage, handling and disposal requirements. Use approved containment vessels and refer to appropriate safety standards. Comply with all applicable transportation standards when shipping refrigerant containers.
- C. Service Equipment and Procedures
1. To minimize refrigerant emissions while recovering the refrigerant, use recycling equipment such as a Trane "recycle / recovery system" or equivalent. Use equipment and methods which will pull the lowest possible system vacuum while recovering and condensing refrigerant. Equipment capable of pulling a vacuum of less than (500 microns - 1.0 mm) of mercury is recommended. Do not open the unit to atmosphere for service work until the refrigerant charge is fully removed/recovered.

2. Evacuation prior to charging should be done with a vacuum pump capable of pulling a vacuum of (500 microns - 1.0 mm) of mercury or less. The unit should stand for 12 hours and the vacuum should not rise above 2,500 microns (2.5 mm) of mercury. A rise above 2,500 microns (2.5 mm) of mercury indicates a leak test is required to locate and repair any leaks. A leak test will be required on any repaired area. Charge refrigerant into the machine only when it is determined that the machine does not leak or contain moisture. Charge refrigerant into the machine by weight. A proper charge is required for efficient machine operation. When charging is complete, purge or drain charging lines into an approved refrigerant container. Seal all used refrigerant containers with approved closure devices to prevent unused refrigerant from escaping to the atmosphere. Take extra care to properly maintain all service equipment directly supporting refrigerant service work such as gauges, hoses, vacuum pumps, and recycling equipment.
3. When cleaning system components or parts, avoid using CFC-11 (R-11) or CFC-113 (R-113). Use only cleaning solvents that do not have ozone depletion factors. Properly dispose of used materials. Refrigeration system cleanup methods using filters and driers are preferred.

#### 2.14 WATER CIRCULATING PUMPS - Base Mounted

- A. Provide horizontally or vertically split-casing type circulating pumps as scheduled on drawings, arranged to permit access to revolving parts without disconnecting suction and discharge piping or moving motor. Pumps shall be fitted with grease lubricated ball bearings to zerk fittings and drain plugs in dust and moisture proof housing, machine fitted to assure permanent, perfect alignment (cast iron casing with bronze fittings). Renewable bronze casing wearing rings shall be provided. Pumps shall be equipped with mechanical seals (and stainless steel shaft sleeves). Provide bronze impeller. Manufacturer shall especially note arrangement of piping for high static heads and shall check the water condition at job site before recommending type of seal or packing gland.
- B. Each pump shall deliver the total gpm listed in the schedule against the total dynamic head listed, and pump characteristic curve shall have a cut-off point at a head no more than 20% or less than 10% above rated discharge head.
- C. The pump shall be mounted on a cast iron or fabricated steel drip-lip subbase and direct connected by Dodge Para-Flex, Woods, Falk or Waldron flexible coupling to the electric motor.
  1. See Section 23 0500 for further motor requirements.
- D. Mount base with assembled pump and motor on 3½" thick concrete housekeeping base. Base of pump shall be tightly packed with wet grout after pump is aligned, leveled and anchored. Install standpipe minimum of 12" high over grout pouring hole to assure that all areas of base are filled. Each pump shall be mounted on an inertia base.
- E. The manufacturer of all pumps shall be responsible for the supervision of the pump installation and field alignment to make sure pumps installed are to their

requirements. Submit alignment report to Architect / Engineer stating pumps are properly aligned.

- F. Suction diffusers with integral strainers shall be provided by the pump manufacturer. Diffusers shall match pumps and shall be provided with support foot and pressure gauge taps.
- G. Acceptable Manufacturers
  - 1. Armstrong
  - 2. Bell and Gossett
  - 3. Aurora
  - 4. Pacific Pump Company
  - 5. Thrush
  - 6. Taco, Inc.
  - 7. Wilo.
- H. Forward shop drawing submittals to the Architect / Engineer for review. Include pump curve with operating point plotted.
- I. Each pump shall be equipped with a VFD. Acceptable VFD manufacturers include ABB, Square D and Dan Foss. The VFD shall be provided by the Temperature Control Contractor.

## 2.15 WATER TREATMENT

- A. Circulating Hot Water Systems
  - 1. Provide and install bypass "shot" feeders welded steel construction with 300 psig working pressure. Feeders shall be installed in all new HW systems and have the following features.
    - a. 5 gallon capacity
    - b. 3.5" fill port with quick opening cover
    - c. 3/4" inlet and outlet connections
    - d. 3/4" vent connection
    - e. Safety cover that cannot be removed while feeder is pressurized
  - 2. Shot feeders shall be piped in accord with manufacturer's details.
  - 3. Acceptable Manufacturers
    - a. Nalco
    - b. Betz
    - c. Dearborn
    - d. JL Wingert Co.
- B. Forward shop drawing submittals to the Architect / Engineer for review.

2.16 EXPANSION JOINTS (Packless Type)

- A. Furnish and install Flexonics type Tube Turns telescopic expansion joints with 2-ply stainless steel bellows for all piping 2.50" and smaller where shown on drawings, or required for expansion of pipes and space does not permit use of fabricated expansion loops.
- B. Furnish and install Flexonics single or dual flexing, as shown on drawings, Tube Turns or ADSCO controlled flexing packless expansion joints with Type 304 stainless steel bellows for all piping 3" and larger where shown on drawings, or required for expansion of pipes and space does not permit use of fabricated expansion loops.

2.17 FLEXIBLE PIPE CONNECTORS

- A. Furnish and install molded "Teflon" flanged flexible couplings on suction and discharge connection of all piping deflections. Furnish connections complete with companion flanges, grommets limit bolts and monel reinforcing rings.
- B. Connectors shall be suitable for continuous operation at 220°F with pressures of 110 psig.
- C. Acceptable Manufacturers
  - 1. Belmont
  - 2. Garlock Inc.
  - 3. John Dore Co.
  - 4. Mercer
  - 5. Metraflex
  - 6. Resistoflex
  - 7. Flex Flo (Thermatech)
- D. Forward shop drawing submittals to the Architect / Engineer for review.

2.18 CENTRIFUGAL PUMPS WITH FLOOR-MOUNTED RECEIVER

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. ITT Corporation; Domestic Pump Division.
  - 2. Roth Pump Company.
  - 3. Skidmore Pump.
  - 4. Spence Engineering Company, Inc.; Division of Circor International, Inc.
  - 5. Spirax-Sarco Inc.
  - 6. Sterling.
- B. Description: Factory-fabricated, packaged, electric-driven pumps; with receiver, pumps, controls, and accessories suitable for operation with steam condensate.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. ASME Compliance: Fabricate and label steam condensate receivers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- C. Configuration: Duplex floor-mounted pumps with receiver and float switches.
- D. Receiver:
1. Floor mounted.
  2. Close-grained cast iron.
  3. Externally adjustable float switches.
  4. Flanges for pump mounting.
  5. Water-level gage and dial thermometer.
  6. Pressure gage at pump discharge.
  7. Bronze gate valves between receiver and pump discharge.
  8. Lifting eyebolts.
  9. Inlet vent and an overflow.
  10. Cast-iron inlet strainer.
- E. Pumps:
1. Centrifugal, close coupled.
  2. Vertical design, permanently aligned, and bronze fitted.
  3. Stainless-steel shafts.
  4. Mechanical seals rated at 250 deg F.
  5. Rated to operate with a minimum of 2 feet of NPSH.
  6. Mounted on receiver flanges.
- F. Motor:
1. Enclosure: Totally enclosed, fan cooled.
  2. Motor Bearings: Grease-lubricated ball bearings.
  3. Efficiency: Premium efficient.
- G. Control Panel:
1. Factory wired between pumps and float switches, for single external electrical connection.
  2. Provide fused, control-power transformer if voltage exceeds 230 V ac.
  3. NEMA 250, Type 1 enclosure with hinged door and grounding lug, mounted on pump.
  4. Motor controller for each pump.
  5. Electrical pump alternator to operate pumps in lead-lag sequence and allow both pumps to operate on receiver high level.
  6. Manual lead-lag control to override electrical pump alternator and manually select the lead pump.
  7. Momentary-contact "TEST" push button on cover for each pump.
  8. Numbered terminal strip.

9. Disconnect switch.

PART 3 - EXECUTION

3.1 DEMOLITION

- A. Pertinent Contractor shall remove all existing materials, system components, accessories and related items that will not be re-used.
- B. HVAC Contractor shall ensure that system is inactive before disabling the system. HVAC Contractor shall ensure that removal of system will not compromise the Owner's operations before removal occurs.
- C. Partial removals shall extend back to nearest active main. Provide and install caps or pipe plugs at main for all piping including pneumatic lines.
- D. No piping shall be left open as a result of demolition operations. Cap or plug all open piping (including pneumatic lines). Crimping is not an acceptable means of capping piping.
- E. Refrigerant associated with demolished systems/equipment shall be reclaimed by HVAC Contractor in accord with applicable regulations. Such refrigerant becomes the property of the HVAC Contractor unless stated otherwise.
- F. All hangers and clamps shall be removed as part of demolition work if they are not re-used.
- G. All removed equipment and materials become the property of the pertinent removing Contractor unless otherwise noted.

3.2 DRAIN LINES

- A. HVAC Contractor shall provide and install a complete drain system from all coil drain pans in all air handling units, fan coils, evaporator coils and cooling coils. On double sloped pans and / or pans with two drain connections provide drains on both sides.
  - 1. Where multiple, stacked cooling coils are used each coil shall have its own drain pan. Provide internal drop tubes from each such pan down to the main drain pan.
- B. All drains shall be trapped. Traps shall be designed to withstand the maximum (positive or negative) pressures imposed on them by service without ponding or retaining water in the pans.
  - 1. Dimension from bottom of pan outlet to trap invert shall be equal to two times unit static pressure (in inches of water) plus unit velocity head (in inches of water).
  - 2. Dimension from bottom of trap to trap outlet shall be equal to two times unit static pressure (in inches of water).



- C. Drain lines shall be the same size as the pan outlet connections.
- D. All drain lines shall slope uniformly to termination point at slope of 1/8" per foot.
- E. Terminate drain lines at floor drains with indirect connection.

### 3.3 PIPE GUIDES AND ANCHORS

- A. Where expansion joints are used, pipes shall be guided two times on each side of the expansion joint. The guides shall be from 5'-0" and 25'-0" from the anchor unless otherwise noted on drawings. Guides shall be reviewed by the Architect / Engineer and shall be so designed as to prevent pipe movement in any direction except along the axis of the pipe run. Also provide guides on vertical pipes in shafts where indicated.
- B. Anchors shall be constructed of steel, shall be such as to prevent pipe movement in any direction, shall be welded to the pipe and shall be securely fastened to the building structure as reviewed by the Architect / Engineer and shall have sufficient strength to withstand the stress that it will be subjected to by the pipe movement.

### 3.4 WELDING

- A. If requested, furnish proof of the competency of each welding operator and, at the request of the Architect / Engineer, have all or any of the welding operators pass a standard qualification test such as ASME, AWS or Hartford Insurance Company procedure and tests. See Specification Section 22 00 10.

### 3.5 PRESSURE TESTS

- A. All testing equipment, labor and accessories shall be provided by the HVAC Contractor.
- B. HVAC Contractor shall disconnect or valve-off all equipment items that could be damaged by testing. All damage resulting from testing shall be the responsibility of the HVAC Contractor.
- C. All tests shall be performed before systems are concealed in building construction by insulation or otherwise made inaccessible.
- D. All leaks shall be repaired. Leaking systems shall be repaired and retested until systems are free of leaks. All damage resulting from leaks shall be the responsibility of the pertinent Contractor.
- E. Tests shall be witnessed by the Architect / Engineer or designated representative.
- F. Submit 3 copies of test reports to Architect / Engineer for record purposes. Tests shall be typewritten, shall be signed by the HVAC Contractor and shall list name(s) of witness(es).

- G. Tests shall be conducted using clear water as the testing media except for refrigeration and compressed air piping. See "Refrigeration piping" for testing of refrigeration piping. Use compressed air for testing of compressed air piping.
- H. All new piping shall be tested by pump pressure to a working pressure of not less than 100 psig. Where operating pressures exceed 50 psig, test pressure shall be two times the working pressure. Test duration shall be two hours for water tests, 8 hours for air tests.
- I. After tests are satisfactorily completed, the piping shall be drained, equipment reconnected and the system made ready for use.

### 3.6 CLEANING THE PIPING SYSTEMS

- A. At completion of installation and before final capacity tests are conducted, thoroughly clean all grease, oil and dirt from all parts of the new piping in a manner satisfactory to the Architect / Engineer.
- B. Flush entire new steam and condensate system with full steam pressure for a period of two hours.
  - 1. Remove trap interiors during cleaning and temporary piping shall be installed to vent steam to outside.
  - 2. After the steam and condensate systems have been flushed, put system back in normal operation with condensate going to drain for a period of one week.
  - 3. Thoroughly clean all new traps after the plant has been in continuous operation for a period of thirty (30) days. Clean trap interiors and remove all foreign matter.
  - 4. Examine and clean all of the new trap strainers and new strainers for all automatic valves.
- C. Cleaning of Chilled/Hot Water Systems
  - 1. Chilled water and hot water heating systems shall be chemically cleaned by one of the methods outlined below:
    - a. Trisodium Phosphate-Caustic  
The system shall be filled with water and for every 100 gallons of system volume, 3 lbs. of trisodium phosphate and 3 lbs. of sodium hydroxide shall be added. This solution shall be circulated for 12 to 24 hours, at 120°F if possible. At end of circulation time begin flushing as outlined below in Section 2. CAUTION: This procedure shall not be used if metals such as aluminum or galvanized are present in the system. The alternate methods "b" or "c" outlined below shall be used in these systems.
    - b. Acrysol QR-1086 and Dequest 2010  
The system shall be filled with water and for every 100 gallons of system volume, 2 gallons of cleaning concentrate shall be added. The cleaning concentrate shall be prepared as follows. In 100 gallons of water, add

the following quantities of chemicals in the following order and mix thoroughly until dissolved. Use a polyethylene drum:

- |     |                               |          |
|-----|-------------------------------|----------|
| (1) | Acrysol QR-1086 (Rohm & Haas) | 41.5 lbs |
| (2) | Dequest 2010 (Monsanto)       | 41.5 lbs |
| (3) | Potassium or Sodium Hydroxide | 12.5 lbs |

The cleaning solution shall be circulated in the system for 24 to 48 hours, preferably under light heat (120°F). If heat cannot be applied then circulate for 48 hours under ambient conditions. At completion of circulation time begin flushing of system as outlined below in Section 2.

c. Drewspense 4945 / Drewspense 4395

These are preblended proprietary cleaning chemicals. Drewspense 4945 is a combination of polymers, chelate, and a gluconic acid derivative designed to remove iron and copper oxides from the system.

Drewspense 4395 is a nonionic surfactant which effectively removes silt, mud, clay, oil and other suspended matter from the system allowing them to be carried out of the system by flushing. To clean a system with this procedure, add 1 gallon of Drewspense 4945 and 1 gallon of Drewspense 4395 per 100 gallons of system volume. If foaming problems develop, the use of an antifoam such as Dow Corning Antifoam A should overcome the foaming tendency of Drewspense 4395. Circulate cleaning solution for 48 hours, at a temperature of 120°F if possible. If heat cannot be applied increase cleaner circulation time to 72 hours. After circulation time begin high velocity flushing as outlined below.

2. A temporary connection to city water with backflow prevention shall be provided to enable high velocity flushing of system. At completion of required cleaner circulation time begin continuous flushing of system while maintaining system full at all times to prevent the introduction of air into the system. Following cleaning, submit samples of system water to independent testing lab to determine if system has been cleaned properly. When cleaning system, ensure that all automatic valves are open to coils so the entire system will circulate and be cleaned. Also remove and clean system strainers following cleaning.

- a. Pertinent Contractor shall be responsible for providing the necessary pumping action to obtain a minimum velocity of 3 ft / sec in the piping being cleaned. Contractor shall be responsible for providing all bypasses and temporary piping necessary to clean the entire system(s).

3. After final cleaning, add 0.5 oz of Nalco 8325 (or approved equal) per gallon of system volume, to provide a nitrite level of 500 to 750 parts per million. This is a glycol compatible blend of corrosion inhibitors and will passivate the cleaned metal surfaces and protect them from corrosion. If filling the system with ethylene glycol, drain only the volume from the system necessary to allow the introduction of glycol into the system. If glycol is not to be added, this blend of inhibitors must be left in the system.

- a. It may require 5 to 10 times the system volume to adequately flush the system. In order to properly clean a system, a minimum velocity of 3 ft per second must be attained in the system piping. If this velocity cannot be developed then manual cleaning methods will have to be used in those areas where this velocity is not achieved.
- 4. In systems which require the use of ethylene glycol based antifreeze solutions to prevent possible freezing and bursting of system piping, the glycol used to fill the system shall be as specified elsewhere.
- 5. Samples submitted to the independent testing laboratory shall meet the following test limits before acceptance of the system.
 

Chloroform extractables	5 PPM (mg/l) or less
Particulate matter	25 PPM (mg/l) or less
	on 1.2 micron media
Corrosion inhibitors	500-1000 as Nitrite
Glycol	To percentage as per project specification.

3.7 CIRCULATION (WATER SYSTEM)

- A. Insure a perfect and noiseless circulation of water and air throughout entire new water system, without pounding or air binding, in any part of the system when operating at gauge pressures varying from 1/4 to 75 lbs.
- B. Arrange all piping to drain by gravity. Provide drain valves with hose connections at all low points in the system, in all isolated sections of piping, at the base of all risers and downstream of all isolation valves.
- C. Properly vent all high points in hot water heating and chilled water piping systems.

END 23 0510

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
  - 1. Motor controllers.
  - 2. Torque, speed, and horsepower requirements of the load.
  - 3. Ratings and characteristics of supply circuit and required control sequence.
  - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

## 2.2 MOTOR CHARACTERISTICS

- A. Duty: Inverter duty rated at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

## 2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Insulation: Class F.
- H. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

## 2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
  - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
  - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.

3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

## 2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
  1. Permanent-split capacitor.
  2. Split phase.
  3. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

## PART 3 - EXECUTION (Not Applicable)

END 23 0513

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Bimetallic-actuated thermometers.
  - 2. Thermowells.
  - 3. Dial-type pressure gages.
  - 4. Gage attachments.
  - 5. Test plugs.
  - 6. Test-plug kits.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Wiring Diagrams: For power, signal, and control wiring.
- C. Product Certificates: For each type of meter and gage, from manufacturer.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide thermometer or comparable product by one of the following:
  - 1. Ashcroft Inc.
  - 2. Ernst Flow Industries.
  - 3. Miljoco Corporation.
  - 4. Tel-Tru Manufacturing Company - AA575R.
  - 5. Trerice, H. O. Co.
  - 6. Weiss Instruments, Inc. - 5VBM.



- B. Standard: ASME B40.200.
- C. Case: Sealed type; stainless steel with 3-inch or 5-inch nominal diameter.
- D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.
- E. Connector Type(s): Union joint, adjustable angle with unified-inch screw threads.
- F. Connector Size: ½ inch, with ASME B1.1 screw threads.
- G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
- H. Window: Plain glass.
- I. Ring: Stainless steel.
- J. Element: Bimetal coil.
- K. Pointer: Dark-colored metal.
- L. Accuracy: Plus or minus 1 percent of scale range.

## 2.2 DUCT-THERMOMETER MOUNTING BRACKETS

- A. Description: Flanged bracket with screw holes, for attachment to air duct and made to hold thermometer stem.

## 2.3 THERMOWELLS

- A. Thermowells:
  1. Standard: ASME B40.200.
  2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
  3. Material for Use with Copper Tubing: CNR or CUNI.
  4. Material for Use with Steel Piping: CRES.
  5. Type: Stepped shank unless straight or tapered shank is indicated.
  6. External Threads: NPS ½, NPS ¾, or NPS 1, ASME B1.20.1 pipe threads.
  7. Internal Threads: ½, ¾, and 1 inch, with ASME B1.1 screw threads.
  8. Bore: Diameter required to match thermometer bulb or stem.
  9. Insertion Length: Length required to match thermometer bulb or stem.
  10. Lagging Extension: Include on thermowells for insulated piping and tubing.
  11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

## 2.4 PRESSURE GAGES

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

1. Basis-of-Design Product: Subject to compliance with requirements, provide gage(s) or comparable product by one of the following:
  - a. AMETEK, Inc.; U.S. Gauge.
  - b. Ashcroft Inc.
  - c. Ernst Flow Industries.
  - d. Miljoco Corporation.
  - e. Tel-Tru Manufacturing Company.
  - f. Trerice, H. O. Co.
  - g. Weiss Instruments, Inc.
2. Standard: ASME B40.100.
3. Case: Sealed type(s); cast aluminum or drawn steel; 4-1/2-inch NOMINAL DIAMETER (6-inch if mounted more than 10 feet above floor).
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

## 2.5 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4, 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
- B. Siphons: Loop-shaped section of stainless-steel pipe with NPS 1/4 pipe threads.
- C. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

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

- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.
- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install valve and snubber in piping for each pressure gage for fluids (except steam).
- I. Install thermometers in the following locations:
  - 1. Where indicated on drawings.
- J. Install pressure gages in the following locations:
  - 1. Suction and discharge of each pump.

### 3.2 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Piping: 0 to 250 deg F.
- B. Scale Range for Air Ducts: Minus 40 to plus 110 deg F.

### 3.3 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Piping: 0 to 100 psi.

END 23 0519

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following hangers and supports for HVAC system piping and equipment:
  - 1. Steel pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Thermal-hanger shield inserts.
  - 5. Fastener systems.
  - 6. Pipe stands.
  - 7. Equipment supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

- A. Product Data: For the following:
  - 1. Steel pipe hangers and supports.

2. Fiberglass pipe hangers.
3. Thermal-hanger shield inserts.
4. Powder-actuated fastener systems.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Pipe stands. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

## 1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
5. ASME Boiler and Pressure Vessel Code: Section IX.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

1. AAA Technology & Specialties Co., Inc.
2. Bergen-Power Pipe Supports.
3. B-Line Systems, Inc.; a division of Cooper Industries.
4. Carpenter & Paterson, Inc.
5. Empire Industries, Inc.
6. ERICO/Michigan Hanger Co.

7. Globe Pipe Hanger Products, Inc.
8. Grinnell Corp.
9. GS Metals Corp.
10. National Pipe Hanger Corporation.
11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.

- B. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- C. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

### 2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

### 2.4 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

- B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.

- C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

### 2.5 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## 2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

- a. Hilti, Inc.
- b. ITW Ramset/Red Head.
- c. Masterset Fastening Systems, Inc.
- d. MKT Fastening, LLC.
- e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

- a. B-Line Systems, Inc.; a division of Cooper Industries.
- b. Empire Industries, Inc.
- c. Hilti, Inc.
- d. ITW Ramset/Red Head.
- e. MKT Fastening, LLC.
- f. Powers Fasteners.

## 2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

## 2.8 MISCELLANEOUS MATERIALS

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

## PART 3 - EXECUTION

### 3.1 ENGINEERED SUPPORT SYSTEM INSTALLED AT EXISTING PLASTER CEILINGS

- A. An engineered support system shall be furnished and installed per Specification Section 05 43 00 and drawing CTR.003 S41-20 by assigned contractor (assignment by construction manager). Division 23 Contractor shall furnish and install all necessary steel supports and associated mounting and fastening hardware to support all Division 23 items requiring support from above (diffusers, ductwork, piping, etc).

### 3.2 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:



1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS ½ to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS ¾ to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS ½ to NPS 24, if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS ½ to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS ¾ to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS ½ to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS ½ to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS ½ to NPS 2.
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS ¾ to NPS 8.
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS ¾ to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS ½ to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.
    - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

### 3.3 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- M. Insulated Piping: Comply with the following:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    - b. NPS 4: 12 inches long and 0.06 inch thick.
    - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
  - 5. Pipes NPS 8 and Larger: Include wood inserts.
  - 6. Insert Material: Length at least as long as protective shield.
  - 7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.4 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.5 METAL FABRICATIONS

- A. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

### 3.6 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### 3.7 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END 23 0529

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Valve tags.
  - 5. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

## 2.1 EQUIPMENT LABELS

### A. Metal Labels for Outdoor Equipment:

1. Material and Thickness: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

### B. Plastic Labels for Indoor Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Blue.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

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

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

## 2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.



- C. Background Color: Yellow.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

### 2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches high.

### 2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
  - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Fasteners: Brass wire-link chain, beaded chain or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or

space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

## 2.5 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
1. Size: 3 by 5-1/4 inches minimum.
  2. Fasteners: Brass grommet and wire.
  3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
  4. Color: Yellow background with black lettering.

## PART 3 - EXECUTION

### 3.1 PREPARATION

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

### 3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### 3.3 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.
  2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  4. At access doors, manholes, and similar access points that permit view of concealed piping.
  5. Near major equipment items and other points of origination and termination.
  6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

B. Pipe Label Schedule:

1. Hot Water Supply Heating. . . . .HWSH
  2. Hot Water Return Heating. . . . .HWRH
  3. Vents. . . . .V
  4. Drain. . . . .D
  5. Refrigerant Liquid. . . . .RL
  6. Refrigerant Suction. . . . .RS
  7. Chilled Water Supply. . . . .CHWS
  8. Chilled Water Return. . . . .CWR
- a. Background Color: Green.
  - b. Letter Color: White.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves and valves within factory-fabricated equipment units. List tagged valves in a valve schedule.

3.5 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END 23 0553

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. Test and Balance Contractor: Test, adjust and balance air and piping systems. Work includes but is not limited to the following.
2. Test and Balance
  - a. Hydronic systems
  - b. Air systems
  - c. Control system tests
  - d. Reports

1.2 RELATED WORK

A. Specified elsewhere:

1. Sections: Architectural / Structural and General Work:
2. Division 23 - Mechanical
3. Division 26 - Electrical

1.3 JOB CONDITIONS

- A. Heating, ventilating, and air conditioning equipment shall be completely installed and in continuous operation to accomplish the testing, adjusting and balancing work specified. Complete air balancing prior to hydronic balancing.
- B. Perform testing, adjusting and balancing when outside conditions approximate design conditions for heating and cooling functions or when the system is operating at design capacity.
- C. The Architect / Engineer may be present during testing and balancing to verify that specified procedures are followed.

1.4 QUALITY ASSURANCE

- A. Testing and balancing shall be performed by independent firms specializing in such work.
  1. The Test and Balance Contractor shall not be related to the Plumbing or HVAC Contractor in any business enterprise.
- B. Only qualified personnel shall perform testing and balancing work.

- C. Submit evidence that the personnel who will perform the testing and balancing of the project systems are qualified personnel for review by the Architect / Engineer prior to performing the work.
- D. Submit a list of completed projects successfully tested and balanced by the submitted qualified personnel for review by the Architect / Engineer, prior to performing the work.
- E. Perform all corrective measures caused by faulty installation. Retest, readjust and rebalance systems until satisfactory results are achieved.

## 1.5 DEFINITION

- A. Qualified personnel are:
  - 1. Personnel who have been certified by one of the following test and balance organizations.
    - a. AABC - Associated Air Balance Council.
    - b. Certified TBAB - Certified Testing, Balancing and Adjusting Bureau.
    - c. NEBB - National Environmental Balancing Bureau, Illinois Chapter.
    - d. SMARTA - Sheet Metal, Air Conditioning & Roofing Contractors Trade Association of Illinois.
    - e. TABIC - Test & Balancing Institute for Certification.

## 1.6 SUBMITTALS

- A. Submit data sheets on each item of testing equipment for Architect / Engineer review. Include name of device, manufacturer's name, model number, latest date of calibration and correction factors.
- B. Submit a report containing all test data and other related information recorded during testing and balancing, placed on appropriate forms for Architect / Engineer review. Reports shall certify that the methods used and results achieved are as specified.

## 1.7 REVERIFICATION

- A. During Substantial Completion Inspection, a percentage (not more than 5%) of the recorded data will be subject to reverification by the Architect / Engineer. Take instrument readings as directed. Test points will be in normally accessible locations and randomly selected by Architect / Engineer.

## PART 2 - PRODUCTS

### 2.1 WATER BALANCING INSTRUMENTS

- A. 30" Mercury U-Tube Manometer, 200 psig wwp, with three valve bypass assembly and return wells or mercury check valves.
- B. Inspector's Gauge Testing Set.

- C. Water Differential Pressure Gauge, 4.50" dial.
- D. Pressure gauge measurements points, quick-connect couplings, 1/4" ips.

## 2.2 AIR BALANCE INSTRUMENTS

- A. Velometer with probes and Pitot tube.
- B. Rotating vane anemometer.
- C. ASHRAE standard Pitot tubes stainless steel 5/16 outside diameter, lengths 18" and 36".
- D. Magnehelic differential air pressure gauges, 0 to 0.5", 0 to 1.0" and 0 to 5.0" water pressure ranges, each arranged as a portable unit for use with a standard Pitot tube.
- E. Combination inclined-vertical portable manometer, range 0 to 5.0" water.
- F. Portable-type hook gauge, range 0 to 12" water.
- G. Portable flexible U-tube manometer, magnetic mounting clips, range 0 to 18" water.
- H. Conical or pyramidal shaped hood.

## 2.3 SYSTEM PERFORMANCE MEASURING INSTRUMENTS

- A. Insertion thermometers, with graduations at 0.1°F or contact pyrometer.
- B. Sling psychrometer.
- C. Tachometer, centrifugal type.
- D. Revolution counter.
- E. Clamp-on volt-ammeter.
- F. Recorders, portable type for temperature and humidity.

## PART 3 - EXECUTION

### 3.1 DRIVES

- A. All VAV systems shall be provided with new, appropriately sized drives such that the full range of the pertinent VFD's is available for control of duct static pressure. VAV systems shall not be balanced using the VFD's.

### 3.2 AIR SYSTEMS

- A. Test, adjust and balance systems in accord with the following:

1. Preliminary:
  - a. Identify and list size, type and manufacturer of all equipment to be tested, including air terminals. Inspect all system components for proper installation and operation.
  - b. Use manufacturers' ratings for all equipment to make calculations except where field test shows ratings to be impractical.
  - c. Verify that all instruments are accurately calibrated and maintained.
  - d. Install clean filters.
  
2. Central System:
  - a. Test, adjust and record supply, return fan RPM to design requirements within the limits of mechanical equipment provided.
  - b. Test and record motor voltage and running amperes including motor nameplate data and starter heater ratings.
  - c. Make pitot tube traverse of main supply, exhaust and return ducts, determine and record cfm at fans and adjust fans to design cfm.
  - d. Test and record system static pressure, suction and discharge.
  - e. Test and adjust system for design minimum outside air, cfm.
  - f. Test and adjust systems for design return air, cfm.
  - g. Test and record heating apparatus entering air temperatures, dry bulb.
  - h. Test and record cooling apparatus entering air temperatures, dry bulb and wet bulb.
  - i. Test and record heating apparatus leaving air temperatures, dry bulb.
  - j. Test and record cooling apparatus leaving air temperatures, dry bulb and wet bulb.
  
3. Distribution: Adjust zones or branch ducts to proper design cfm, supply and return.
  
4. Air Terminals:
  - a. Identify each air terminal from reports as to location and determine required flow reading.
  - b. Test and adjust each air terminal to within 10% of design requirement.
  - c. Test procedure on air terminals shall include comparison of specified fpm velocity and observed velocity, adjustment of terminal and comparison of specified cfm and observed cfm after adjustment.
  - d. Adjust flow patterns from air terminal units to minimize drafts to extent design and equipment permits.
  
5. Verification:
  - a. Prepare summation of readings of observed cfm for each system, compare with specified cfm and verify that duct losses are within specified allowable range. Determine coil and filter static pressure drops.
  - b. Verify design cfm at fans as described above.

### 3.3 TESTING, BALANCING AND ADJUSTING

- A. At the completion of the installation of the air distribution systems, the following tests shall be made.
- B. All instruments for testing are to be furnished by this Contractor and must be reviewed by the Architect / Engineer before use on job. All readings shall be recorded on approved forms. All instruments used shall be recently calibrated and same set of instruments shall be used throughout the balancing procedures.
- C. The air distribution systems shall be balanced with the volume dampers, splitter dampers and adjustable air extractors in the duct systems as follows:
  - 1. All air handling equipment in building shall be operating during the balancing procedures. Supply systems with return fans shall be balanced in the 100% outside air position. System shall then be set in minimum outside air position and manual volume damper after automatic return air dampers adjusted to maintain constant supply air volume. Supply systems without return fans shall be adjusted to the minimum outside air position. All filters shall be new and clean. All volume dampers and extractors shall be set at 2/3 open position.
  - 2. Fans shall be adjusted to specified air quantities by using rotating vane anemometer traverse over entering air face of cooling coils in built-up air handling systems, with pitot tube and inclined manometer or a velometer having proper duct jet attachment for traverse at fan inlet.
  - 3. Individual outlets shall be adjusted to specified air quantities using either the "proportional method" starting at last outlet and working towards main or the "trial and error" method, with a velometer having proper attachment or a rotating vane anemometer.
  - 4. Branch ducts (having more than one outlet) shall be adjusted to specified air quantities by using a pitot tube and inclined anemometer or a velometer having proper duct jet attachment for traverse as near to takeoff as practical.
  - 5. Above procedures shall essentially be followed for all systems and shall be repeated until proper balance is achieved throughout systems from -0% to +10% of specified air quantities.
- D. After balance is completed, lock nuts or stop screws shall be installed at all volume dampers and extractors to permit them to be shut-off but prevent opening beyond the set balance position.
- E. For more detailed step-by-step procedures the Balancing and Adjustment Manual for Air Distribution Systems published by Sheet Metal and Air Conditioning Contractors National Association shall be used.
- F. All readings taken throughout the balancing procedure shall be recorded on approved forms and upon completion of balancing and testing shall be "certified" as being correct and submitted for review.
- G. Upon receipt of "certified" balancing forms and letter of certification that all balancing, testing and adjusting is completed in accordance with plans and specifications and that all systems are operating properly, the Architect / Engineer or his designated



representative will conduct a balance inspection. Furnish personnel, instruments and equipment as required to assist the Architect / Engineer during this "balance inspection".

- H. If during the above balance inspection any portion of any system is found in improper balance, that entire system shall be rebalanced and a new report submitted. The rebalance shall be checked and if again found in improper balance, this Contractor shall again rebalance and submit report. This procedure shall be repeated until the systems are properly balanced to the satisfaction of the Architect / Engineer.

### 3.4 HYDRONIC HEATING SYSTEMS

- A. Test, adjust and balance system in accordance with the following requirements:

- 1. Preliminary:

- a. List all mechanical specifications of tested equipment and verify against contract documents. Inspect all system components for proper installation and operation. Clean all screens.
- b. Open all line valves to full open position. Close coil bypass stop valves, then set mixing control valve to full coil flow.
- c. For each pump, verify rotation, test, and record pump shut-off head, and test and record pump wide-open head.
- d. Verify proper water level in expansion tanks and in the system. Verify that system is entirely full of fluid. Vent all air vents.
- e. Verify that air vents in high points of water systems are installed and operating freely.
- f. Verify that all instruments are accurately calibrated and maintained.

- 2. Central Equipment:

- a. Set chilled water and hot water pumps to proper flow quantity.
- b. Adjust flow of chilled water through chiller to design value.
- c. Adjust flow of hot water through heat exchangers to design quantity.
- d. Adjust steam pressure at PRV and record at each steam heat exchanger.
- e. Observe leaving water temperatures and return water temperatures at chiller and heat exchangers. Reset to correct design temperatures.
- f. Record pump operating suction and discharge pressures. Determine final dynamic head.

- 3. Distribution:

- a. Balance flow to each chilled water coil and hot water coil.
- b. Record steam pressure at each steam coil.

- 4. Terminal Units

- a. Upon completion of flow readings and adjustments at coils, mark all settings and record following data:

- (1) Inlet water temperatures.
  - (2) Leaving water temperatures.
- b. Observe fluid pressure drop through coil at set flow rate on call for full cooling and for full heating.
  - c. Set valve in bypass to match coil flow pressure drop on full bypass.
5. Verification:
- a. Record rated and actual running amperage for each pump motor. Measure and record gpm of all pumps.
  - b. Record total dynamic head for each pump.

### 3.5 AUTOMATIC CONTROL SYSTEM

- A. The Temperature Control Contractor shall set and adjust automatically operated devices to achieve specified sequence of operation.
- B. Testing organization shall verify all controls for proper calibration and list those controls requiring adjustment by temperature control system installer.

### 3.6 SYSTEM PERFORMANCE REPORT

- A. After the conclusion of balancing operations, make temporary installation of portable recorders and simultaneously record temperatures and humidity during summer and winter conditions at representative locations in each system.
- B. Architect / Engineer will direct all test locations.
- C. Make recordings during summer and winter for a seven-day period, continuous over a weekend, and including at least one period of operation at outside conditions within 5°F wet bulb temperature of maximum summer design condition and within 10°F dry bulb temperature of minimum winter design condition.
- D. Report of test results shall include original recording and two reproductions.

### 3.7 SUBMISSION OF REPORTS

- A. Fill in test results on approved forms.
- B. Submit three certified copies of required test reports to the Architect / Engineer for review.
- C. Include in report a list of instruments used and test date of calibration.
- D. Submittals shall be legibly signed by the individual(s) responsible for the accuracy of the

END 23 0593

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. Provide and install complete insulation systems as shown on the drawings and as specified herein. Work includes, but is not limited to, the following:

- a. HVAC Contractor: Insulating of:

- (1) Hot water heating piping
- (2) Chilled water piping
- (3) Refrigerant piping
- (4) Ductwork

1.2 RELATED WORK

A. Specified elsewhere:

1. Division 23 - Mechanical Systems

1.3 QUALITY ASSURANCE

- A. Installations shall be by qualified personnel thoroughly trained and experienced in the skills required and completely familiar with the manufacturer's current recommended methods of installation as well as the requirements of the work.
- B. All insulation shall be applied in accordance with MICA "Commercial and Industrial Insulation Standards".

1.4 SUBMITTALS

- A. See Architectural Sections.
- B. Provide submittals for:
  1. Pipe insulation
  2. Equipment insulation
  3. Plastic insulation jacket
  4. Duct insulation

## PART 2 - PRODUCTS

### 2.1 INSULATION

- A. Materials of insulation shall be manufactured by Johns-Manville, Schuller, Owens Corning, Knauf, Rubatex, Armstrong, Certain-Teed (acceptable manufacturers will vary depending upon material being specified herein after).
- B. Insulation shall be rigid glass fiber with fire retardant vapor barrier jacket. Insulation of fittings shall be in accordance with manufacturer's recommendations using glass fiber wrapping and formed jacket.
- C. Insulating materials and APT jackets shall conform to latest NFPA and IECC standards with flame-spread rating not to exceed 25 and smoke developed rating not to exceed 50. Vapor barrier jackets shall have a water vapor permeability rating not to exceed .02 perms when tested in accordance with ASTM Standard E-96.
- D. Flexible fire retardant elastomeric thermal insulation for use on refrigerant piping and equipment in cold piping systems (strainers, pumps, special valves) shall be manufactured by Armstrong, Schuller or Rubatek. Insulation shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less. Seal all joints with appropriate adhesive. On equipment, such as strainers, the insulation shall be installed so that those portions of the equipment which require servicing will have removable sections for access.
  - 1. Do not use elastomeric insulation on surfaces that exceed 120°F.
  - 2. Pertinent Contractors shall be responsible for ensuring that use of this material in return air plenums is in full compliance with all codes and is acceptable to the authority having jurisdiction. This matter shall be resolved before shop drawings are submitted.
  - 3. Elastomeric insulation shall not be used on two-pipe heating / cooling.
- E. Specialties
  - 1. All hot piping fittings and cold fittings and flanges shall be wrapped with low density glass fiber blanket insulation built up to same thickness as adjacent insulation and wired in place with 20 gauge copper clad annealed wire. Cover with plastic pre-fab jacket and seal joint and end overlaps with white nylon tape.
  - 2. All cold water valves, control valves, unions and other fittings requiring access shall be insulated with elastomeric foam or fiberglass of the same thickness and type as the rest of the system.
  - 3. Covering on all pipe fittings shall be notched on the interior of fittings and shall pass unbroken through hangers and pipe sleeves.
  - 4. Valves, unions, relief valves and strainers shall be insulated.
  - 5. Valves, unions, strainers and flanges in heating hot water piping need not be covered. Insulation shall be tapered back, neatly cemented and covered same as fittings to permit access to the joint, valve and strainer without disturbing covering.
  - 6. Insulation and vapor barrier on cold piping systems shall be continuous and shall prevent condensation and water problems.

7. All piping carrying cold fluid shall be insulated with elastomeric insulation coated with two coats of paintable coating where exposed to UV light indoors. Cover elastomeric insulation with PVC jacket outdoors and where exposed to abrasions in light traffic areas indoors and outdoors.

F. Equipment - Hot

1. Insulate equipment with operating temperature to 450°F insulate with high density (3pcf min.) fiberglass. K-Factor 0.27 max at 75°F, thickness as specified. Attach using 16 gauge copper clad annealed wire or weld pins and washers 12" on center.
2. Finish for equipment heads and irregular surface where jacketed fiberglass insulation is used shall be as follows: Apply 10-10 fiberglass mesh with coat of fire retardant mastic. Apply second coat of fire retardant mastic over mesh for smooth finish.

ITEMS	THICKNESS
Hot Water Air Separator	2" Fiberglass

G. Equipment - Cold

1. Insulate the following equipment with 1" thick layer of fire retardant elastomeric insulation having a flame-spread rating of less than 25 in accordance with the latest NFPA standards.

ITEMS  
 Chilled Water Pumps  
 Chilled Water Strainers

2. Insulation shall be applied with a full coating of adhesive, as recommended by the manufacturer.
3. The insulation on all pumps and strainers shall be easily removable for service.
4. Do not use elastomeric on surfaces that exceed 120°F.

H. Piping

1. Covering on all piping shall pass unbroken through hangers and pipe sleeves with insulation protection saddles. Molded fiberglass saddles shall be directly adhered to insulation jacket using an appropriate glue.

a. Acceptable Manufacturers:

- (1) Buckaroos, Inc.
- (2) Pipeshield, Inc.
- (3) B-Line Systems, Inc.
- (4) Centerline

2. Where section of water pipe 2-1/2" and larger passes through hangers, provide fiberglass plug inserts to prevent crushing of insulation. Size of pipe shall indicate number of plug to insert, i.e., 2" = 2 plugs, 4" = 4 plugs, etc. Provide 7¼ lbs.

density insulation on pipe 2" and smaller extending 6" beyond ends of metal jacket. Insulation shall be of same thickness as specified material. Vapor barrier shall not be damaged.

a. Acceptable Manufacturers:

- (1) Buckaroos, Inc.
- (2) Pipesield, Inc.
- (3) B-Line Systems, Inc.
- (4) Centerline

- 3. All laps in jacket shall be on top of horizontal pipes and toward the wall in vertical pipes and shall be sealed with staples and flame retardant adhesive. Laps shall be a minimum of 3" at end joints and 1-1/2" on longitudinal joints.
- 4. Insulate the following piping as described below, or as noted on drawings:
- 5. Apply 3-1/2 lb minimum density, 0.27 maximum k factor / inch fiberglass pipe insulation on piping systems.
- 6. Apply 3-1/2 lb minimum density, 0.27 maximum k factor / inch fiberglass pipe insulation on piping systems in accordance with the following:

HWSH - Hot Water Supply Heating  
 HWRH - Hot Water Return Heating  
 HWRRH - Hot Water Reverse Return Heating

PIPE SIZE	INSULATION THICKNESS
1-1/2" and less	1-1/2"
2" and greater	2"

LPS - Low Pressure Steam Piping  
 LPR - Low Pressure Return Piping

PIPE SIZE	INSULATION THICKNESS
1-1/2" and less	1-1/2"
2" and greater	2"

CHWS - Chilled Water Supply  
 CHWR - Chilled Water Return  
 CHWRR - Chilled Water Reverse Return

PIPE SIZE	INSULATION THICKNESS
All Sizes	1-1/2"

- 7. Apply elastomeric foam pipe insulation on piping systems in accordance with the following maximum k factor 0.27 / inch:

Refrigerant piping and all VRF equipment piping  
 Drain lines from cooling equipment

PIPE SIZE	INSULATION THICKNESS
All	1"

8. Apply elastomeric foam pipe insulation on piping system in accord with the following maximum k factor 0.27 / inch (can be used in lieu of fiberglass if allowed by Code):

CHWS, CHWR	
Cold Control Valves	
PIPE SIZE	INSULATION THICKNESS
All Sizes	1-1/2"

9. Seal ends of insulation and inside surface of insulation to pipe every 21' on straight runs, at each side of fittings and valves and at all equipment.
10. Insulation on piping in concealed locations may use permanently treated (not salt treatment) flame-retardant jacket. Jackets on hot lines in concealed locations may be stapled without use of adhesive as specified above.

## 2.2 MINERAL-FIBER INSULATION INSTALLATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
  - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
  - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
  - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
  - d. Do not overcompress insulation during installation.
  - e. Impale insulation over pins and attach speed washers.
  - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

- a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
  - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
- a. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
  - b. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

**B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.**

- 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
- 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
- 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
  - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
  - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
  - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
  - d. Do not overcompress insulation during installation.
  - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
- 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory-



or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

- a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
  - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
  6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### PART 3 - EXECUTION

#### 3.1 INSULATING PIPING

- A. Provide all pipe covering, thermal insulation, protective jacketing, saddles, shields and plugs for the systems in their contracts as specified. Work shall be performed by skilled mechanics regularly engaged in the application of pipe insulation.
- B. No insulation shall be applied until all pressure tests have been successfully completed.

#### 3.2 PIPING OUTDOORS

- A. Pipe insulation installed outdoors shall be protected by:
  1. Weathertight aluminum jacketing for piping greater than 2". Provide PVC jacketing for piping 2" and smaller.
- B. Elastomeric 1-1/2" thick pipe insulation installed outdoors shall be protected by aluminum jacketing or PVC jacketing.

#### 3.3 DUCT INSULATION

- A. Supply, outdoor, relief air (between dampers and outdoors) and exhaust air (between dampers and outdoors) duct insulation shall be the following:
  1. Mineral Fiber Blanket: 1-1/2 inches thick, 1.0 lb / cu. ft. nominal density.
- B. Access doors and fire dampers shall be insulated with the following:

1. Mineral Fiber Blanket: 1-1/2 inches thick, 1.0 lb / cu. ft. nominal density.
- C. Exposed ductwork in finished areas shall be insulated with the following:
1. Mineral Fiber Board Insulation: 1-1/2 inches thick,  $\geq 3$  lb / cu. ft. nominal density.
  2. Board insulation to be painted shall have all service jacket.
  3. Board insulation not to be painted shall have foil jacket.
  4. Supply ductwork from heating only make-up air units does not require duct insulation. The discharge air temperature shall not exceed in a difference of 15 degrees F compared to the surrounding space temperature.
  5. Exposed round ductwork to be double wall insulated spiral.
- D. Finish areas include storage rooms, server rooms and bus
- E. Concealed type 1 kitchen hood exhaust duct and plenum insulation shall be fire-rated blanket or board; thickness as required to achieve 2 hour fire rating.
- F. Generator exhaust and muffler insulation shall be fire-rated blanket or board; thickness as required to achieve 2 hour fire rating.

END 23 0700

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.
- B. Related Sections include the following:
  - 1. Division 23 Section "Meters and Gages for HVAC Piping" for measuring equipment that relates to this Section.
  - 2. Division 23 Section "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.

1.3 DEFINITIONS

- A. DDC: Direct digital control.
- B. I/O: Input/output.
- C. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.
- D. MS/TP: Master slave/token passing.
- E. PC: Personal computer.
- F. PID: Proportional plus integral plus derivative.
- G. RTD: Resistance temperature detector.
- H. IP: Internet protocol.

## 1.4 SYSTEM PERFORMANCE

### A. Comply with the following performance requirements:

1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
  - a. Water Temperature: Plus or minus 1 deg F.
  - b. Water Flow: Plus or minus 5 percent of full scale.
  - c. Water Pressure: Plus or minus 2 percent of full scale.
  - d. Space Temperature: Plus or minus 1 deg F.
  - e. Ducted Air Temperature: Plus or minus 1 deg F.
  - f. Outside Air Temperature: Plus or minus 2 deg F.
  - g. Dew Point Temperature: Plus or minus 3 deg F.
  - h. Temperature Differential: Plus or minus 0.25 deg F.
  - i. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
  - j. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
  - k. Air Pressure (Space): Plus or minus 0.01-inch wg.
  - l. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
  - m. Carbon Dioxide: Plus or minus 50 ppm.
  - n. Electrical: Plus or minus 5 percent of reading.

## 1.5 SUBMITTALS

- ### A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.

2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
  3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
  2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
  3. Wiring Diagrams: Power, signal, and control wiring.
  4. Details of control panel faces, including controls, instruments, and labeling.
  5. Written description of sequence of operation.
  6. Schedule of dampers including size, leakage, and flow characteristics.
  7. Schedule of valves including flow characteristics.
  8. DDC System Hardware:
    - a. Wiring diagrams for control units with termination numbers.
    - b. Schematic diagrams and floor plans for field sensors and control hardware.
    - c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
  9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
  10. Controlled Systems:
    - a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
    - b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
    - c. Written description of sequence of operation including schematic diagram.
    - d. Points list.
- C. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.
- D. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with LonWorks.
- E. Samples for Initial Selection: For each color required, of each type of thermostat or sensor cover with factory-applied color finishes.
- F. Samples for Verification: For each color required, of each type of thermostat or sensor cover.
- G. Software and Firmware Operational Documentation: Include the following:

1. Software operating and upgrade manuals.
  2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
  3. Device address list.
  4. Printout of software application and graphic screens.
  5. Software license required by and installed for DDC workstations and control systems.
- H. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.
- I. Qualification Data: For Installer and manufacturer.
- J. Field quality-control test reports.
- K. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
  2. Interconnection wiring diagrams with identified and numbered system components and devices.
  3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
  4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
  5. Calibration records and list of set points.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with ASHRAE 135 for DDC system components.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where the equipment manufacturer's factory packaged controls are capable of providing the BAS interface specified, the equipment manufacturer's controls may be utilized. Where controls are provided by other than the equipment manufacturer, arrange for shipping of required devices to equipment manufacturer for factory mounting as required for proper equipment function.
- B. System Software: Update to latest version of software at Project completion.

## 1.8 COORDINATION

- A. Coordinate location of thermostats and other exposed control sensors with plans and room details before installation.
- B. Coordinate equipment with Division 27 Section "Clock Systems" to achieve compatibility with equipment that interfaces with that system.
- C. Coordinate equipment with Division 26 Section "Network Lighting Controls" to achieve compatibility with equipment that interfaces with that system.
- D. Coordinate equipment with Division 28 Section "Fire Detection and Alarm" to achieve compatibility with equipment that interfaces with that system.
- E. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.
- F. Coordinate equipment with Division 26 Section "Electrical Power Monitoring and Control" to achieve compatibility of communication interfaces.
- G. Coordinate equipment with Division 26 Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.
- H. Coordinate equipment with Division 26 Section "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

## 1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Replacement Materials: One replacement for each unique valve motor, controller, thermostat, positioning relay.
  - 2. Maintenance Materials: Five thermostat adjusting key(s).

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 CONTROL SYSTEM

- A. Manufacturers:
  1. Alpha Controls.
- B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.
- C. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation shall permit interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.
- D. Expand existing temperature control system software database to include all new controlled mechanical equipment. Control system shall be accessible via campus Ethernet network.

## 2.3 DDC EQUIPMENT

- A. Operator Workstation and Printer: Existing operator workstation and printer are to be retained.
  1. Application Software: Modify existing temperature control software as necessary to provide the level of control specified herein for new and existing equipment and systems.
    - a. I/O capability from operator station.
    - b. System security for each operator via software password and access levels.
    - c. Automatic system diagnostics; monitor system and report failures.
    - d. Database creation and support.
    - e. Automatic and manual database save and restore.
    - f. Dynamic color graphic displays with up to 10 screen displays at once.
    - g. Custom graphics generation and graphics library of HVAC equipment and symbols.
    - h. Alarm processing, messages, and reactions.
    - i. Trend logs retrievable in spreadsheets and database programs.
    - j. Alarm and event processing.
    - k. Object and property status and control.
    - l. Automatic restart of field equipment on restoration of power.
    - m. Data collection, reports, and logs. Include standard reports for the following:
      - 1) Current values of all objects.



- 2) Current alarm summary.
- 3) Disabled objects.
- 4) Alarm lockout objects.
- 5) Logs.

- n. Custom report development.
- o. Utility and weather reports.
- p. Workstation application editors for controllers and schedules.
- q. Maintenance management.

2. Custom Application Software:

- a. English language oriented.
- b. Full-screen character editor/programming environment.
- c. Allow development of independently executing program modules with debugging/simulation capability.
- d. Support conditional statements.
- e. Support floating-point arithmetic with mathematic functions.
- f. Contains predefined time variables.

B. Diagnostic Terminal Unit: Portable notebook-style, PC-based microcomputer terminal capable of accessing system data by connecting to system network with minimum configuration as follows:

- 1. System: With one integrated USB 2.0 port, integrated Intel Pro 10/100 (Ethernet), integrated audio, bios, and hardware monitoring.
- 2. Processor: Core 2, 2.0 GHz.
- 3. Random-Access Memory: 1.0 GB.
- 4. Graphics: Video adapter, minimum 1024 x 768 pixels, 64-MB video memory.
- 5. Monitor: 15 inches, LCD color.
- 6. Keyboard: QWERTY 105 keys in ergonomic shape.
- 7. Hard-Disk Drive: 80 Gb.
- 8. CD-ROM Read/Write Drive: 48x24x48.
- 9. Pointing Device: Touch pad or other internal device.

C. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.

- 1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
- 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
  - a. Global communications.
  - b. Discrete/digital, analog, and pulse I/O.
  - c. Monitoring, controlling, or addressing data points.

- d. Software applications, scheduling, and alarm processing.
  - e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
3. Standard Application Programs:
- a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, antishort cycling, PID control, DDC with fine tuning, and trend logging.
  - b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
  - c. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
  - d. Remote communications.
  - e. Maintenance management.
  - f. Units of Measure: Inch-pound and SI (metric).
4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
5. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
6. LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.
- D. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
- 1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
  - 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
    - a. Global communications.
    - b. Discrete/digital, analog, and pulse I/O.
    - c. Monitoring, controlling, or addressing data points.
  - 3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
  - 4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
  - 5. LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.
- E. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
  2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
  3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
  4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
  5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
  6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
  7. Universal I/Os: Provide software selectable binary or analog outputs.
- F. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
1. Output ripple of 5.0 mV maximum peak to peak.
  2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
  3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.
- G. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
1. Minimum dielectric strength of 1000 V.
  2. Maximum response time of 10 nanoseconds.
  3. Minimum transverse-mode noise attenuation of 65 dB.
  4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

## 2.4 UNITARY CONTROLLERS

- A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
  2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.
  3. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using

MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.

4. LonWorks Compliance: Communicate using EIA/CEA 709.1 datalink/physical layer protocol using LonTalk protocol.
5. Enclosure: Dustproof rated for operation at 32 to 120 deg F.
6. Enclosure: Waterproof rated for operation at 40 to 150 deg F.

## 2.5 ANALOG CONTROLLERS

- A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.
- B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F, and single- or double-pole contacts.
- C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
  1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.
- D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.

## 2.6 ELECTRONIC SENSORS

- A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
- B. Thermistor Temperature Sensors and Transmitters:
  1. Manufacturers:
    - a. BEC Controls Corporation.
    - b. Ebtron, Inc.
    - c. Heat-Timer Corporation.
    - d. I.T.M. Instruments Inc.
    - e. MAMAC Systems, Inc.
    - f. RDF Corporation.
  2. Accuracy: Plus or minus 0.5 deg F at calibration point.
  3. Wire: Twisted, shielded-pair cable.

4. Insertion Elements in Ducts: Single point; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
5. Averaging Elements in Ducts: 72 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft..
6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.
7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
  - a. Set-Point Adjustment: Concealed.
  - b. Set-Point Indication: Exposed.
  - c. Thermometer: Red-reading glass.
8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

C. RTDs and Transmitters:

1. Manufacturers:
  - a. BEC Controls Corporation.
  - b. MAMAC Systems, Inc.
  - c. RDF Corporation.
2. Accuracy: Plus or minus 0.2 percent at calibration point.
3. Wire: Twisted, shielded-pair cable.
4. Insertion Elements in Ducts: Single point, 8 inches or 18 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
5. Averaging Elements in Ducts: 48 inches long, rigid; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
6. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
  - a. Set-Point Adjustment: Concealed.
  - b. Set-Point Indication: Exposed.
  - c. Thermometer: Red-reading glass.
8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

D. Humidity Sensors: Bulk polymer sensor element.

1. Manufacturers:
  - a. BEC Controls Corporation.
  - b. General Eastern Instruments.
  - c. MAMAC Systems, Inc.
  - d. ROTRONIC Instrument Corp.
  - e. TCS/Basys Controls.

- f. Vaisala.
2. Accuracy: 5 percent full range with linear output.
  3. Room Sensor Range: 20 to 80 percent relative humidity.
  4. Room Sensor Cover Construction: Manufacturer's standard locking covers.
    - a. Set-Point Adjustment: Exposed.
    - b. Set-Point Indication: Exposed.
  5. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
  6. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of minus 22 to plus 185 deg F.
  7. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.
- E. Pressure Transmitters/Transducers:
1. Manufacturers:
    - a. BEC Controls Corporation.
    - b. General Eastern Instruments.
    - c. MAMAC Systems, Inc.
    - d. ROTRONIC Instrument Corp.
    - e. TCS/Basys Controls.
    - f. Vaisala.
  2. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
    - a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
    - b. Output: 4 to 20 mA.
    - c. Building Static-Pressure Range: 0- to 0.25-inch wg.
    - d. Duct Static-Pressure Range: 0- to 5-inch wg.
  3. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
  4. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.
  5. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
  6. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.
- F. Room Sensor Cover Construction: Manufacturer's standard locking covers.
1. Set-Point Adjustment: Exposed.

2. Set-Point Indication: Exposed.
- G. Room sensor accessories include the following:
1. Insulating Bases: For sensors located on exterior walls.
  2. Adjusting Key: As required for calibration and cover screws.
- H. Photocell, see Section 23 0993 for description.

## 2.7 STATUS SENSORS

- A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg.
- B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig, piped across pump.
- C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.
- D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.
- E. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.
- F. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.
- G. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
- H. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.
1. Manufacturers:
    - a. BEC Controls Corporation.
    - b. I.T.M. Instruments Inc.

## 2.8 GAS DETECTION EQUIPMENT

### A. Manufacturers:

1. B. W. Technologies.
2. CEA Instruments, Inc.
3. Ebtron, Inc.
4. Gems Sensors Inc.
5. Greystone Energy Systems Inc.
6. Honeywell International Inc.; Home & Building Control.
7. INTEC Controls, Inc.
8. I.T.M. Instruments Inc.
9. MSA Canada Inc.
10. QEL/Quatrosense Environmental Limited.
11. Sauter Controls Corporation.
12. Sensidyne, Inc.
13. TSI Incorporated.
14. Vaisala.
15. Vulcain Inc.

B. Carbon Dioxide Sensor and Transmitter: Single detectors using solid-state infrared sensors; suitable over a temperature range of 23 to 130 deg F and calibrated for 0 to 2 percent, with continuous or averaged reading, 4- to 20-mA output; for wall mounting.

C. Oxygen Sensor and Transmitter: Single detectors using solid-state zircon cell sensing; suitable over a temperature range of minus 32 to plus 1100 deg F and calibrated for 0 to 5 percent, with continuous or averaged reading, 4- to 20-mA output; for wall mounting.

D. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment; for flush mounting.

## 2.9 THERMOSTATS

### A. Manufacturers:

1. Same as Direct Digital Controller Manufacturer.

B. Combination Thermostat and Fan Switches: Line-voltage thermostat with push-button or lever-operated fan switch.

1. Label switches "FAN ON-OFF".
2. Mount on single electric switch box.

C. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.



- D. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.
1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.
  2. Selector Switch: Integral, manual on-off-auto.
- E. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.
1. Bulbs in water lines with separate wells of same material as bulb.
  2. Bulbs in air ducts with flanges and shields.
  3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.
  4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
  5. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.
  6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.
- F. Fire-Protection Thermostats: Listed and labeled by an NRTL acceptable to authorities having jurisdiction; with fixed or adjustable settings to operate at not less than 75 deg F above normal maximum operating temperature, and the following:
1. Reset: Manual.
  2. Reset: Automatic, with control circuit arranged to require manual reset at central control panel; with pilot light and reset switch on panel labeled to indicate operation.
- G. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.
- H. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.
- I. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic- reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.
1. Bulb Length: Minimum 20 feet.
  2. Quantity: One thermostat for every 20 sq. ft. of coil surface.
- J. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic- reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above set point.

1. Bulb Length: Minimum 20 feet.
  2. Quantity: One thermostat for every 20 sq. ft. of coil surface.
- K. Heating/Cooling Valve-Top Thermostats: Proportional acting for proportional flow, with molded-rubber diaphragm, remote-bulb liquid-filled element, direct and reverse acting at minimum shutoff pressure of 25 psig, and cast housing with position indicator and adjusting knob.
- L. Thermostats shall be provided by the Temperature Control Subcontractor and compatible with the BAS. Night setback and thermostat settings shall be controlled by BAS.

## 2.10 HUMIDISTATS

- A. Manufacturers:
1. MAMAC Systems, Inc.
  2. ROTRONIC Instrument Corp.
- B. Duct-Mounting Humidistats: Electric insertion, 2-position type with adjustable, 2 percent throttling range, 20 to 80 percent operating range, and single- or double-pole contacts.

## 2.11 ACTUATORS

- A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
1. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
  2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
  3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. X lbf and breakaway torque of 300 in. X lbf.
  4. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. X lbf.
  5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. X lbf and breakaway torque of 300 in. X lbf.
  6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. X lbf.
- B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
1. Manufacturers:

- a. Schneider Electric.
2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
  3. Dampers: Size for running torque calculated as follows:
    - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
    - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
    - c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
    - d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
    - e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
    - f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
  4. Coupling: V-bolt and V-shaped, toothed cradle.
  5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
  6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
  7. Power Requirements (Two-Position Spring Return): 24-V ac.
  8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
  9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
  10. Temperature Rating: Minus 22 to plus 122 deg F.
  11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
  12. Run Time: 12 seconds open, 5 seconds closed.

## 2.12 CONTROL VALVES

- A. Manufacturers:
  1. Schneider Electric.
  2. Siemens.
  3. Honeywell.
- B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
- C. Hydronic system globe valves shall have the following characteristics:
  1. NPS 2 and Smaller: Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
  2. NPS 2-1/2 and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
  3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.
    - a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.

- b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.
  - 4. Sizing: 3-psig maximum pressure drop at design flow rate or the following:
    - a. Two Position: Line size.
    - b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
    - c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.
  - 5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
  - 6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.
- D. Butterfly Valves: 200-psig, 150-psig maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
- 1. Body Style: Wafer.
  - 2. Disc Type: Aluminum bronze.
  - 3. Sizing: 1-psig maximum pressure drop at design flow rate.

## 2.13 DAMPERS

- A. Manufacturers:
  - 1. Air Balance Inc.
  - 2. Don Park Inc.; Autodamp Div.
  - 3. TAMCO (T. A. Morrison & Co. Inc.).
  - 4. United Enertech Corp.
  - 5. Vent Products Company, Inc.
- B. Dampers: AMCA-rated, opposed-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.
  - 1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with oil-impregnated sintered bronze blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
  - 2. Operating Temperature Range: From minus 40 to plus 200 deg F.
  - 3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.

4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. X lbf; when tested according to AMCA 500D.

#### 2.14 CONTROL CABLE

- A. Electronic and fiber-optic cables for control wiring are specified in Division 27 Section "Communications Horizontal Cabling."

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that conditioned power supply is available to control units and operator workstation.
- B. Verify that pneumatic piping and duct-, pipe-, and equipment-mounted devices are installed before proceeding with installation.

#### 3.2 INSTALLATION

- A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.
- B. Connect and configure equipment and software to achieve sequence of operation specified.
- C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above the floor.
  1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- D. Install guards on thermostats in the following locations:
  1. Entrances.
  2. Public areas.
  3. Where indicated.
- E. Install automatic dampers according to Division 23 Section "Air Duct Accessories."
- F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

- G. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."
- H. Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."
- I. Install refrigerant instrument wells, valves, and other accessories according to Division 23 Section "Refrigerant Piping."
- J. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.
- K. Install electronic and fiber-optic cables according to Division 27 Section "Communications Horizontal Cabling."

### 3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."
- B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Install signal and communication cable according to Division 27 Section "Communications Horizontal Cabling."
  - 1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
  - 2. Install exposed cable in raceway.
  - 3. Install concealed cable in raceway.
  - 4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
  - 5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
  - 6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
  - 7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
- D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
  
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
  - 2. Test and adjust controls and safeties.
  - 3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
  - 4. Test each point through its full operating range to verify that safety and operating control set points are as required.
  - 5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
  - 6. Test each system for compliance with sequence of operation.
  - 7. Test software and hardware interlocks.
  
- C. DDC Verification:
  - 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
  - 2. Check instruments for proper location and accessibility.
  - 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
  - 4. Check instrument tubing for proper fittings, slope, material, and support.
  - 5. Check installation of air supply for each instrument.
  - 6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
  - 7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
  - 8. Check temperature instruments and material and length of sensing elements.
  - 9. Check control valves. Verify that they are in correct direction.
  - 10. Check DDC system as follows:
    - a. Verify that DDC controller power supply is from emergency power supply, if applicable.
    - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
    - c. Verify that spare I/O capacity has been provided.
    - d. Verify that DDC controllers are protected from power supply surges.
  
- D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

### 3.5 ADJUSTING

#### A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:
  - a. Check analog inputs at 0, 50, and 100 percent of span.
  - b. Check analog outputs using milliamper meter at 0, 50, and 100 percent output.
  - c. Check digital inputs using jumper wire.
  - d. Check digital outputs using ohmmeter to test for contact making or breaking.
  - e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
5. Flow:
  - a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
  - b. Manually operate flow switches to verify that they make or break contact.
6. Pressure:
  - a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
  - b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
7. Temperature:
  - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
  - b. Calibrate temperature switches to make or break contacts.
8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

#### B. Adjust initial temperature and humidity set points.



- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

END 23 0900

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes control sequences for HVAC systems, subsystems, and equipment.
- B. Related Sections include the following:
  - 1. Division 23 Section "Instrumentation and Control for HVAC" for control equipment and devices and for submittal requirements.

1.3 DEFINITIONS

- A. DDC: Direct digital control.

1.4 CONTROLLED SYSTEMS

- A. This system is intended to provide automatic control of the following systems and equipment. Control systems shall be complete with all items of labor and material necessary to give specified performance.
  - 1. All unit heaters
  - 2. All exhaust fans
  - 3. Hot water heating system pumps and boilers
  - 4. Chilled water system pumps
  - 5. All air handling units
  - 6. Reheat coils
  - 7. Chiller

1.5 AIR HANDLING UNITS

- A. The AHU's shall come complete with VFD provided and installed by Temperature Control Contractor. The Temperature Control Contractor shall provide and field install DDC controllers. The variable volume air handling unit consists of a mixed air section with minimum outdoor air

(two-position), outdoor air (modulating), exhaust air and return air dampers, pre-filter, final filter, glycol heating coil, chilled water cooling coil, supply and relief / exhaust fans with variable frequency drives. The unit is DDC controlled using electric actuation.

- B. The air handling unit is scheduled for automatic operation on a scheduled basis.
- C. Warm-Up Mode - The supply fans start. The mixing dampers are positioned for 100% return air, the heating coil valve opens and the cooling coil valve remains closed. If time reaches the latest start time during the Warm-Up mode, the outdoor air damper opens to its minimum position. The system is prevented from entering the Warm-Up mode more than once per day.
- D. Cool-Down Mode - The supply fans start. The cooling coil valve and the mixing dampers modulate to maintain the supply air temperature set point. When the outdoor air dry bulb temperature is above the economizer changeover value, the mixing dampers position for 100% return air. If time reaches the latest start time during the Cool-Down mode, the outdoor air damper opens to its minimum position or is controlled in economizer operation. The system is prevented from entering the Cool-Down mode more than once per day.
- E. When the outside air dry bulb temperature is below the economizer changeover value, the heating section, cooling coil valve and mixing dampers modulate in sequence without overlap to maintain the supply air temperature set point with a low limit of 48 degrees F (9 degrees C) at the mixed air sensor. The mixing dampers ramp open slowly to minimize overshooting.
- F. When the outside air dry bulb temperature is above the economizer changeover value, the mixing dampers are placed in the minimum outdoor air position. The heating and cooling coil valves stage in sequence without overlap to maintain the supply air temperature set point.
- G. Supply Duct and Building Pressurization Control - The supply fan variable frequency drive modulate to maintain a constant duct static pressure of 1.5 inches of water as sensed at least 2/3 of the distance downstream of the supply fans in either the longest or most critical duct run. The return fan variable frequency drive modulates to maintain the differential CFM set point to maintain a positive building pressure differential. The supply CFM to return CFM differential set point is 0% if the OA damper is closed. Upon shutdown of the air handling system, the supply and return fans variable frequency drives are stopped and the speed signal goes to zero speed.
- H. Minimum OA Control - Outside air intake dampers controlled to maintain specified minimum outside air quantity at all times. The unit shall have a minimum OA airflow during occupied hours as listed on the schedule. The OA dampers shall modulate to satisfy the space CO<sub>2</sub> setpoints.
- I. Discharge high static and suction low static cutouts on the supply fan, smoke detectors in the supply and return air streams, and supply and relief / exhaust fans VFD fault alarms de-energize the supply and relief / exhaust fans upon activation. When the OAT is less than 45 degrees F (7 degrees C), the heating coil valve modulates to maintain the mixed air temperature at 54 degrees F (7 degrees C). All other dampers and valves position to their normal position after the fans are de-energized.
- J. A low temperature detector in the discharge of the heating coil de-energizes the supply fan when temperatures below 38 degrees F (3 degrees C) are sensed. The heating coil valve modulates to

maintain the mixed air temperature at 54 degrees F (7 degrees C). All other dampers and valves position to their normal position after the fans are de-energized.

- K. Current switches are installed on the load side of the supply and relief / exhaust fans VFDs. The DDC system uses the switches to confirm the fans are in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control. The DDC system generates a VFD trouble alarm independent from the fan status.
- L. During economizer free cooling operation as the need for additional outside air exceeds the airflow of the associated ERV, the RTU OA damper shall modulate open and relief fan shall energize to maintain space differential pressure. Relief fans associated with air handler shall modulate independently to maintain positive building / space pressure. Coordinate final location of space differential pressure sensors with HVAC and General Contractors.
- M. AHU-5 only: Remote switch (to be located in storm shelter away from VFD) shall have the ability to force VFD into bypass mode allowing motor to run at full speed. When in bypass mode, motor shall run at full speed completely independent of building automation system such that damage to BAS components shall not infringe on motor's ability to operate. Switch and wiring shall provide a contact closure to put VFD in bypass mode and shall be furnished and installed by electrical trade.

#### 1.6 CHILLED WATER PUMPS WITH VARIABLE FREQUENCY DRIVES

- A. The chilled water system consists of two chilled water pumps with individual variable frequency drives. The system is DDC controlled with electric actuation.
- B. Chilled Water Pump Alternation - Chilled water pumps alternate to equalize runtime. Selection of the lead pump is evaluated on a weekly basis. The pump with the least runtime is the lead pump. The pump with the most runtime is the lag pump.
- C. Chilled Water Pump Control - The variable frequency drive modulates pump speed to maintain system differential pressure of 20 PSI (adjustable) as sensed near the end of the piping run. If the system differential pressure is below set point and the lead pump is at 100% speed for a time interval of 15 minutes, the lag pump starts. With both pumps on, the variable frequency drives are modulated in unison to maintain system differential pressure. If the system differential is at set point and both pumps are on and at 45% speed for a time interval of 15 minutes the lag pump is stopped.
- D. The DDC system uses current switches to confirm the lead pump is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control. If the lead pump goes into alarm, the lag pump starts.

#### 1.7 HOT WATER SYSTEM AND VARIABLE SPEED HOT WATER PUMPS

- A. Heating Control - The heating system enable point is controlled either manually by the operator or by a program function (i.e., Time-Of-Day). If the heating system enable point is on, the lead hot water pump starts.
- B. The hot water supply set point is reset based on outdoor air temperature. When the outdoor air temperature is 0 degrees F (-18 degrees C), the set point is 180 degrees F (82 degrees C) and when the outdoor air temperature is 60 degrees F (16 degrees C), the set point is 120 degrees F (49 degrees C).
- C. Pump Alternation - Pumps alternate to equalize equipment runtime. Selection of the lead and second pump is evaluated on a weekly basis. The pump with the least runtime is the lead. The remaining pump is second. If the lead pump fails, an alarm is generated and the second pump starts.
- D. Heating Water Pump Speed Control - The variable frequency drive modulates pump speed to maintain system differential pressure of 20 PSI (adjustable) as sensed near the end of the secondary piping run. If the system differential pressure is below set point and the lead pump is at 100% speed for a time interval of 15 minutes, the lag pump starts. With both pumps on, the variable frequency drives are modulated in unison to maintain system differential pressure. If the system differential is at set point and both pumps are on and at 45% speed for a time interval of 15 minutes the lag pump is stopped.
- E. The DDC system uses current switches to confirm the pumps are in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

#### 1.8 REHEAT COILS - DDC OPERATORS

- A. The space served by the reheat coil is controlled in Occupied and Unoccupied modes as follows.
- B. Occupied - The controller monitors the room temperature sensor and modulates the reheat valve to maintain the room temperature at set point.
- C. Unoccupied - The terminal unit is controlled using the night set point. The controller may reset to the Occupied mode for a predetermined time period upon a signal from the control system or manually at the room sensor.

#### 1.9 MISCELLANEOUS CONTROLS

- A. Boiler Controls: Boilers shall come complete with their factory control package. Provide boiler system enable from BAS.
- B. AHU Relief / Exhaust Fans: Power Roof Ventilators: Provide scheduled start/stop, fan run status, and speed control signals. Provide VFD's to EC for installation and wiring.
- C. Provide monitoring of domestic hot water heating system and provide control of hot water circulating pumps.

D. Provide monitoring and alarm for high level limit for storm and sewage ejector pumps.

1.10 GAS-FIRED UNIT HEATERS

A. Heaters will cycle off thermostat to maintain space temperature. The User shall have the ability to change setpoint and utilize night set back.

1.11 EXHAUST FANS

A. A signal from BAS places fan in occupied mode.

B. Fan runs continuously while in occupied mode.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END 23 0993



PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

1.2 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410a:
  - 1. Suction Lines for Air-Conditioning Applications: 320 psig.
  - 2. Suction Lines for Heat-Pump Applications: 520 psig.
  - 3. Hot-Gas and Liquid Lines: 520 psig.

1.3 SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
  - 1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."



## 1.5 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

## PART 2 - PRODUCTS

### 2.1 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8.
- F. Flexible Connectors:
  - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
  - 2. End Connections: Socket ends.
  - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
  - 4. Pressure Rating: Factory test at minimum 500 psig.
  - 5. Maximum Operating Temperature: 250 deg F.

### 2.2 VALVES AND SPECIALTIES

- A. Diaphragm Packless Valves:
  - 1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
  - 2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
  - 3. Operator: Rising stem and hand wheel.
  - 4. Seat: Nylon.
  - 5. End Connections: Socket, union, or flanged.
  - 6. Working Pressure Rating: 500 psig.
  - 7. Maximum Operating Temperature: 275 deg F.
- B. Packed-Angle Valves:

1. Body and Bonnet: Forged brass or cast bronze.
2. Packing: Molded stem, back seating, and replaceable under pressure.
3. Operator: Rising stem.
4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
5. Seal Cap: Forged-brass or valox hex cap.
6. End Connections: Socket, union, threaded, or flanged.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

C. Check Valves:

1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.
4. Closing Spring: Stainless steel.
5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
6. End Connections: Socket, union, threaded, or flanged.
7. Maximum Opening Pressure: 0.50 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 275 deg F.

D. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

E. Safety Relief Valves: Provided by manufacturer.

F. Thermostatic Expansion Valves: Provided by manufacturer.

G. Moisture/Liquid Indicators: Provided by manufacturer.

H. Replaceable-Core Filter Dryers: Provided by manufacturer.

I. Permanent Filter Dryers: Provided by manufacturer.

J. Liquid Accumulators: Provided by manufacturer.

## 2.3 REFRIGERANTS

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

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Atofina Chemicals, Inc.
  2. DuPont Company; Fluorochemicals Div.
  3. Honeywell, Inc.; Genetron Refrigerants.
  4. INEOS Fluor Americas LLC.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.
- B. Hot-Gas and Liquid Lines: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.
- C. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.

### 3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install diaphragm packless valves in liquid and discharge lines of compressor.
- B. Install service valves for gage taps at strainers if they are not an integral part of strainers.
- C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.
- E. Install a full-sized, three-valve bypass around filter dryers.
- F. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.
- G. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- H. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected.

- I. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.
- J. Install flexible connectors at compressors.

### 3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Refer to Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls" for solenoid valve controllers, control wiring, and sequence of operation.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

N. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install traps and double risers to entrain oil in vertical runs.
3. Liquid lines may be installed level.

O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

Q. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

### 3.4 PIPE JOINT CONSTRUCTION

A. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

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

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BA<sub>g</sub>, cadmium-free silver alloy for joining copper with bronze or steel.

### 3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.

5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
  2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
  3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
  4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.
- D. Support multifloor vertical runs at least at each floor.

### 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
1. Comply with ASME B31.5, Chapter VI.
  2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
  3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
    - a. Fill system with nitrogen to the required test pressure.
    - b. System shall maintain test pressure at the manifold gage throughout duration of test.
    - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

### 3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
1. Install core in filter dryers after leak test but before evacuation.
  2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
  3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
  4. Charge system with a new filter-dryer core in charging line.

### 3.8 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
  - 1. Open shutoff valves in condenser water circuit.
  - 2. Verify that compressor oil level is correct.
  - 3. Open compressor suction and discharge valves.
  - 4. Open refrigerant valves except bypass valves that are used for other purposes.
  - 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

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PART 1 - GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. Mechanical Contractor: Work includes the following HVAC water-treatment systems:
  - a. Chemical treatment test equipment.
  - b. HVAC water-treatment chemicals.

1.2 DEFINITIONS

- A. EEPROM: Electrically erasable, programmable read-only memory.
- B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
- C. TDS: Total dissolved solids.

1.3 PERFORMANCE REQUIREMENTS

- A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.
- B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
- C. Closed hydronic systems, including (2) glycol hot water and chilled water loop systems, shall have the following water qualities:
  1. Propylene Glycol
    - a. This product shall be an industrially inhibited ethylene glycol based antifreeze solution to provide freeze and corrosion protection in HVAC systems such as chilled water and hot water heating systems. The product shall not make use of any silicate containing corrosion inhibitors and should not be formulated to provide corrosion protection for aluminum or galvanized metals. The product shall be formulated to provide corrosion protection for the common metals of construction in HVAC



systems such as steel, copper, brass, bronze, solders, etc. Corrosion rates on these metals as determined under ASTM D1384 shall not exceed 0.5 mils penetration per year.

Composition	% By Weight
Ethylene Glycol (Total Glycols)	92.5%
Dye, Inhibitors and Water	7.5%
Specific Gravity 60/60 F	1.133-1.140
Reserve Alkalinity (ASTM D1121)	Minimum 20 ml
Sulfates and Chlorides Total	50 ppm
pH (50% Solution)	8.5-9.0

- b. The product shall contain a small percentage of an effective antifoam compound, (such as Dow Corning Antifoam A) to prevent the formation of foam.
  - c. The product shall be furnished in 55 gallon steel drums which are in good condition and shall be fitted with standard bung plugs and seals to prevent contamination of product.
2. Solutions shall be 30% ethylene glycol by weight, 14% ethylene glycol by volume. Galvanized steel and / or aluminum shall not be used in contact with glycol solutions.
  3. Provide fractional horsepower self-priming transfer pump to allow filling of glycol systems. Pump shall be 120 VAC, cord and plug connected with hose end fittings. Provide 15' length of 3/4" flexible hose with hose end fittings to match hose bibb threads and pump fittings. Turn pump and hose over to Owner upon project completion and obtain receipt.
  4. Water used in ethylene glycol systems shall be potable, free of foreign materials, and shall have low (below 50 ppm) levels of chloride, sulfate and hard water ions.
  5. Procedure to introduce ethylene glycol to systems:
    - a. Sample the local potable water supply. If levels of chloride, sulfate or hard water hardness exceed 50 ppm, then provide acceptable water from off-site and notify the Architect / Engineer in writing so arrangements can be made by the Owner for a water-softening service.
    - b. Calculate the amount of ethylene glycol required based on system volume.
    - c. Pressure test system. Repair all leaks.
    - d. Drain enough water from system to provide space for ethylene glycol.
    - e. Add the correct amount of inhibited ethylene glycol solution and water.
    - f. Circulate solution for at least 24 hours to ensure complete mixing. Withdraw one sample per system and forward sample to ethylene glycol manufacturer for analyses. Analyses shall include concentration, freeze point, pH, reserve alkalinity and appearance. Submit in a report the degradation products, scale promoters, contaminants, corrosives and inhibitors. Forward copies of potable water and of glycol analyses to Architect / Engineer.
  6. Stencil test dates on expansion tanks below system volume figures.
  7. Glycol systems shall be separated from potable water systems by air gaps or by code-approved backflow preventers.
  8. Acceptable Manufacturers

- a. Arco Chemical - Chill Safe
  - b. Dow Chemical Dowtherm 4000
  - c. DuPont or Interstate Intercool OP-100-RA-25 (800-322-6145)
  - d. Union Carbide UCAR Food Freeze
9. Forward shop drawing submittals to Architect / Engineer for review. Automotive anti-freeze is not acceptable.
- D. Passivation for Galvanized Steel: For the first 60 days of operation.
1. pH: Maintain a value within 7 to 8.
  2. Calcium Carbonate Hardness: Maintain a value within 100 to 300 ppm.
  3. Calcium Carbonate Alkalinity: Maintain a value within 100 to 300 ppm.

#### 1.4 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for the following products:
1. Chemical solution tanks.
  2. Chemical test equipment.
  3. Chemical material safety data sheets.
- B. Shop Drawings: Pretreatment and chemical treatment equipment showing tanks, maintenance space required, and piping connections to HVAC systems. Include plans, elevations, sections, details, and attachments to other work.
1. Wiring Diagrams: Power and control wiring.
- C. Field quality-control test reports.
- D. Other Informational Submittals:
1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in the "Performance Requirements" Article above.
  2. Water Analysis: Illustrate water quality available at Project site.
  3. Passivation Confirmation Report: Verify passivation of galvanized-steel surfaces, and confirm this observation in a letter to Architect.

#### 1.5 QUALITY ASSURANCE

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

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

## 1.6 MAINTENANCE SERVICE

- A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion, scale formation, and biological growth for geothermal ground loop system and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion, and shall include the following:
  - 1. Initial water analysis and HVAC water-treatment recommendations.
  - 2. Startup assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
  - 3. Periodic field service and consultation.
  - 4. Customer report charts and log sheets.
  - 5. Laboratory technical analysis.
  - 6. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ampion Corp.
  - 2. Anderson Chemical Co, Inc.
  - 3. Aqua-Chem, Inc.; Cleaver-Brooks Div.
  - 4. Barclay Chemical Co.; Water Management, Inc.
  - 5. Boland Trane Services
  - 6. GE Betz.
  - 7. GE Osmonics.
  - 8. H-O-H Chemicals, Inc.
  - 9. Metro Group. Inc. (The); Metropolitan Refining Div.
  - 10. ONDEO Nalco Company.
  - 11. Watcon, Inc.

### 2.2 STAINLESS-STEEL PIPES AND FITTINGS

- A. Stainless-Steel Tubing: Comply with ASTM A 269, Type 316.
- B. Stainless-Steel Fittings: Complying with ASTM A 815/A 815M, Type 316, Grade WP-S.
- C. Two-Piece, Full-Port, Stainless-Steel Ball Valves: ASTM A 351, Type 316 stainless-steel body; ASTM A 276, Type 316 stainless-steel stem and vented ball, carbon-filled TFE seats, threaded body design with adjustable stem packing, threaded ends, and 250-psig SWP and 600-psig CWP ratings.
- D. Three-Piece, Full-Port, Stainless-Steel Ball Valves: ASTM A 351, Type 316 stainless-steel body; ASTM A 276, Type 316 stainless-steel stem and vented ball, threaded body design with adjustable stem packing, threaded ends, and 150-psig SWP and 600-psig CWP rating.

### 2.3 CHEMICAL TREATMENT TEST EQUIPMENT

- A. Test Kit: Manufacturer-recommended equipment and chemicals in a wall-mounting cabinet for testing pH, TDS, inhibitor, chloride, alkalinity, and hardness; sulfite and testable polymer tests for high-pressure boilers, and oxidizing biocide test for open cooling systems.
- B. Sample Cooler:
  - 1. Tube: Sample.
    - a. Size: NPS 1/4 tubing.
    - b. Material: ASTM A 666, Type 316 stainless steel.
    - c. Pressure Rating: Minimum 2000 psig.
    - d. Temperature Rating: Minimum 850 deg F.
  - 2. Shell: Cooling water.
    - a. Material: ASTM A 666, Type 304 stainless steel.
    - b. Pressure Rating: Minimum 250 psig.
    - c. Temperature Rating: Minimum 450 deg F.
  - 3. Capacities and Characteristics:
    - a. Tube: Sample.
      - 1) Flow Rate: 0.25 gpm.
      - 2) Entering Temperature: 400 deg F.
      - 3) Leaving Temperature: 88 deg F.
      - 4) Pressure Loss: 6.5 psig.
    - b. Shell: Cooling water.
      - 1) Flow Rate: 3 gpm.

- 2) Entering Temperature: 70 deg F.
- 3) Pressure Loss: 1.0 psig.

C. Corrosion Test-Coupon Assembly: Constructed of corrosive-resistant material, complete with piping, valves, and mild steel and copper coupons. Locate copper coupon downstream from mild steel coupon in the test-coupon assembly.

1. Two-station rack for closed-loop systems.

## 2.4 CHEMICALS

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

B. Water Softener Chemicals:

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

## PART 3 - EXECUTION

### 3.1 WATER ANALYSIS

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

### 3.2 INSTALLATION

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

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

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

D. Mount sensors and injectors in piping circuits.

E. Bypass Feeders: Install in closed hydronic systems, including geothermal ground loop system and equipped with the following:

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

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with dielectric fittings. Dielectric fittings are specified in Division 23 Section "Common Work Results for HVAC."
- D. Install shutoff valves on HVAC water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Division 23 Section "General-Duty Valves for HVAC Piping."
- E. Refer to Division 22 Section "Domestic Water Piping Specialties" for backflow preventers required in makeup water connections to potable-water systems.
- F. Confirm applicable electrical requirements in Division 26 Sections for connecting electrical equipment.
- G. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- H. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
  1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.
4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
7. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
8. Repair leaks and defects with new materials and retest piping until no leaks exist.

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

E. Sample boiler water at one-week intervals after boiler startup for a period of five weeks, and prepare test report advising Owner of changes necessary to adhere to Part 1 "Performance Requirements" Article for each required characteristic. Sample boiler water at eight-week intervals following the testing noted above to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section.

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

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

1. Silica: ASTM D 859.
2. Steam System: ASTM D 1066.
3. Acidity and Alkalinity: ASTM D 1067.
4. Iron: ASTM D 1068.
5. Water Hardness: ASTM D 1126.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment. Refer to Division 01 Section "Demonstration and Training."
- B. Training: Provide a "how-to-use" self-contained breathing apparatus video that details exact operating procedures of equipment.

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Double-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.
7. Louvers.
8. Single-wall round ducts and fittings.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Lindab Inc.
  2. McGill AirFlow LLC.
  3. SEMCO Incorporated.
  4. Sheet Metal Connectors, Inc.
  5. Lapine Metal Products
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.
- C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
    - a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
  2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
    - a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
    - b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
  3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch- diameter perforations, with overall open area of 23 percent.
- E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Cover insulation with polyester film complying with UL 181, Class 1.

## 2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G60.
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
  - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.4 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CertainTeed Corporation; Insulation Group.
    - b. Johns Manville.
    - c. Knauf Insulation.
    - d. Owens Corning.
  - 2. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

## 2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
  - 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
  - 2. Tape Width: 4 inches.
  - 3. Sealant: Modified styrene acrylic.
  - 4. Water resistant.
  - 5. Mold and mildew resistant.
  - 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  - 7. Service: Indoor and outdoor.
  - 8. Service Temperature: Minus 40 to plus 200 deg F.
  - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
- C. Water-Based Joint and Seam Sealant:
  - 1. Application Method: Brush on.
  - 2. Solids Content: Minimum 65 percent.
  - 3. Shore A Hardness: Minimum 20.
  - 4. Water resistant.
  - 5. Mold and mildew resistant.
  - 6. VOC: Maximum 75 g/L (less water).
  - 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  - 8. Service: Indoor or outdoor.
  - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
  - 10. VOC: Maximum 395 g/L.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
  - 1. General: Single-component, acid-curing, silicone, elastomeric.
  - 2. Type: S.
  - 3. Grade: NS.
  - 4. Class: 25.
  - 5. Use: O.
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

## 2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
  1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

## 2.7 LOUVERS

- A. Provide and install extruded aluminum louvers in walls as shown on drawings and as specified herein.
- B. Intake louvers shall be 4" deep double hook design arranged to permit bottom of duct to hook over bottom blade for drainage to outside.
- C. Louvers in other walls shall have wall flange on sides, top and bottom.
- D. All louvers shall be constructed of minimum .081 extrusions, with reinforcing bosses and bars as required.
- E. Furnish 5/8" mesh removable bird screens on inside of all louvers, constructed of .063 wire with extruded frames.
- F. Louvers shall have color anodized finish. Final louver finish shall be selected by Architect/Engineer at shop drawing review stage. Submit color samples with shop drawings.
- G. All louvers shall have AMCA rating and label. The manufacturer shall furnish air pressure loss and water penetration data with all submittals.
- H. Acceptable manufacturers: Air Balance Inc., Chicago, Illinois; The Airolite Co., Marietta, Ohio; American Warming and Vent Co., Inc., Toledo, Ohio; Arrow United, Long Island City, New York; and Vent Products Co., Inc., Chicago, Illinois. Ruskin.

- I. Provide insulated panels to blank off unused portion(s) of louvers not used for ducted connections:
  - 1. Panels shall be insulated with 1" thick rigid closed cell foam enclosed in 22 gage (minimum) sheet metal.
  - 2. Prime panels with rust-resistant paint, color selected by Architect.
  - 3. Panels shall be anodized aluminum in color to match louver.
- J. Forward shop drawing submittals to the Architect/Engineer for review.

## 2.8 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards".
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Lindab Inc.
    - b. McGill AirFlow LLC.
    - c. SEMCO Incorporated.
    - d. Sheet Metal Connectors, Inc.
    - e. Spiral Manufacturing Co., Inc.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards", "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards", "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
  - 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards", "90 Degree Tees and Laterals", "Conical Tees", for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## PART 3 - EXECUTION

### 3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. All ducts shall be of size indicated on the drawings. In no case shall the indicated duct size be changed without written approval of the Architect / Engineer.
- C. Duct sizes shown on drawings are met inside area. Where duct lining is specified, increase duct sizes to allow for lining.
- D. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- E. Install round and flat-oval ducts in maximum practical lengths.
- F. Install ducts with fewest possible joints.
- G. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- H. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- I. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- J. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- K. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- L. Where ducts pass through non-fire rated interior partitions, seal around duct with non-combustible material.
- M. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.



- N. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- O. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

### 3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.
- F. Support all horizontal ducts up to 46" wide with field punched steel strap hangers, sized per SMACNA, placed down side, turned under bottom of ducts and securely fastened to the building construction in an approved manner. Ducts from 47" up to 70" wide shall have 1.50" x 1.50" x 3/16" angle iron trapeze hangers with 3/8" diameter rods attached to building construction. Ducts from 71" up to 118" wide shall have 2.50" x 2" x 5/16" angle iron trapeze hangers with ½" diameter rods attached to building construction. Space horizontal duct supports not more than 8'-0" apart. All hangers and stiffeners shall be galvanized steel.
- G. No piping, conduit, ceiling supports or any other building element shall be suspended from duct supports.
- H. Carefully check the arrangement of ducts and dimensions of all working spaces at the building so that there will be no interference with the running of ducts. Carefully lay out all openings in floors and walls.
- I. Increase duct sizes gradually, not exceeding 15° divergence or convergence in duct runs.
- J. Where plenum-type takeoffs or runouts are shown and at all flex duct connections to rectangular ducts, the area of opening into main duct shall be a minimum of 150% of branch duct area.

### 3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 2. Outdoor, Supply-Air Ducts: Seal Class A.
  - 3. Outdoor, Exhaust Ducts: Seal Class C.
  - 4. Outdoor, Return-Air Ducts: Seal Class C.
  - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
  - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
  - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
  - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
  - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
  - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
  - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
  - 12. Conditioned Space, Return-Air Ducts: Seal Class C.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### 3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.6 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

### 3.7 START UP

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

### 3.8 DUCT SCHEDULE

#### A. Supply Ducts:

##### 1. Ducts Connected to Fan Coil Units, Heat Pumps, and Terminal Units:

- a. Pressure Class: Positive 2-inch wg.
- b. Minimum SMACNA Seal Class: B.
- c. SMACNA Leakage Class for Rectangular: 12.
- d. SMACNA Leakage Class for Round and Flat Oval: 12.

##### 2. Ducts Connected to Constant-Volume Air-Handling Units:

- a. Pressure Class: Positive 3-inch wg.
- b. Minimum SMACNA Seal Class: A.
- c. SMACNA Leakage Class for Rectangular: 6.
- d. SMACNA Leakage Class for Round and Flat Oval: 6.

#### B. Return Ducts:

##### 1. Ducts Connected to Fan Coil Units, Heat Pumps, and Terminal Units:

- a. Pressure Class: Positive or negative 2-inch wg.
  - b. Minimum SMACNA Seal Class: B.
  - c. SMACNA Leakage Class for Rectangular: 12.
  - d. SMACNA Leakage Class for Round and Flat Oval: 12.
2. Ducts Connected to Air-Handling Units:
- a. Pressure Class: Positive or negative 2-inch wg.
  - b. Minimum SMACNA Seal Class: B.
  - c. SMACNA Leakage Class for Rectangular: 6.
  - d. SMACNA Leakage Class for Round and Flat Oval: 6.
- C. Exhaust Ducts:
1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
- a. Pressure Class: Negative 2-inch wg.
  - b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
  - c. SMACNA Leakage Class for Rectangular: 12.
  - d. SMACNA Leakage Class for Round and Flat Oval: 6.
2. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.
- a. Exposed to View: Type 304, 14 gauge, stainless-steel sheet, No. 4 finish.
  - b. Concealed: Type 304, stainless-steel sheet, No. 2D finish or 14 gauge carbon steel sheet.
  - c. Welded seams and joints.
  - d. Pressure Class: Positive or negative 3-inch wg.
  - e. SMACNA Leakage Class: 3.
- D. Liner:
- 1. Return Air Ducts (Where Shown on the Drawings): Fibrous glass, Type I, 1 inch thick.
  - 2. Exhaust / Relief Ducts (Where Shown on the Drawings): Fibrous glass, Type I, 1 inch thick.
- E. Elbow Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
- a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
  - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
  - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
  - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
    - 1) Radius-to Diameter Ratio: 1.5.
  - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
  - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam or welded.

F. Exposed Ductwork in Finished Areas:

1. Exposed round ductwork to be double wall insulated.
2. Exposed rectangular ductwork to be board insulated and paintable.

END 23 3113

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Fire dampers.
5. Flange connectors.
6. Turning vanes.
7. Duct-mounted access doors.
8. Flexible connectors.
9. Flexible ducts.
10. Duct accessory hardware.

B. Related Sections:

1. Division 23 Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
2. Division 28 Section "Fire Detection and Alarm" for duct-mounted fire and smoke detectors.

1.3 SUBMITTALS

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

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

- a. Special fittings.
  - b. Manual volume damper installations.
  - c. Control damper installations.
  - d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
  - e. Duct security bars.
  - f. Wiring Diagrams: For power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- D. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

#### 1.5 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G60.
  - 2. Exposed-Surface Finish: Mill phosphatized.

- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and No. 4 finish for exposed ducts.
- D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Air Balance Inc.; a division of Mestek, Inc.
  - 2. American Warming and Ventilating; a division of Mestek, Inc.
  - 3. Cesco Products; a division of Mestek, Inc.
  - 4. Duro Dyne Inc.
  - 5. Greenheck Fan Corporation.
  - 6. Lloyd Industries, Inc.
  - 7. Nailor Industries Inc.
  - 8. NCA Manufacturing, Inc.
  - 9. Pottorff; a division of PCI Industries, Inc.
  - 10. Ruskin Company.
  - 11. SEMCO Incorporated.
  - 12. Vent Products Company, Inc.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 2000 fpm.
- D. Maximum System Pressure: 1-inch wg.
- E. Frame: galvanized sheet steel or extruded aluminum with welded corners.
- F. Blades: Multiple single-piece blades, center-pivoted, maximum 6-inch width, roll-formed aluminum with sealed edges.
- G. Blade Action: Parallel.
- H. Blade Seals: Extruded vinyl, mechanically locked or neoprene, mechanically locked.



- I. Return Spring: Adjustable tension.
- J. Bearings: Steel ball or synthetic pivot bushings.
- K. Accessories:
  - 1. Adjustment device to permit setting for varying differential static pressure.
  - 2. Counterweights and spring-assist kits for vertical airflow installations.
  - 3. Electric actuators.
  - 4. Chain pulls.
  - 5. Bird screen.

## 2.3 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Air Balance Inc.; a division of Mestek, Inc.
    - b. American Warming and Ventilating; a division of Mestek, Inc.
    - c. Flexmaster U.S.A., Inc.
    - d. McGill AirFlow LLC.
    - e. METALAIRE, Inc.
    - f. Nailor Industries Inc.
    - g. Pottorff; a division of PCI Industries, Inc.
    - h. Ruskin Company.
    - i. Trox USA Inc.
    - j. Vent Products Company, Inc.
  - 2. Standard leakage rating, with linkage outside airstream.
  - 3. Suitable for horizontal or vertical applications.
  - 4. Frames:
    - a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
    - b. Mitered and welded corners.
    - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
  - 5. Blades:
    - a. Multiple or single blade.
    - b. Parallel- or opposed-blade design.
    - c. Stiffen damper blades for stability.
    - d. Galvanized-steel, 0.064 inch thick.
  - 6. Blade Axles: Galvanized steel.
  - 7. Bearings:

- a. Oil-impregnated bronze or molded synthetic.
  - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Galvanized steel.

## 2.4 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. Air Balance Inc.; a division of Mestek, Inc.
  - 2. Arrow United Industries; a division of Mestek, Inc.
  - 3. Cesco Products; a division of Mestek, Inc.
  - 4. Greenheck Fan Corporation.
  - 5. McGill AirFlow LLC.
  - 6. METALAIRE, Inc.
  - 7. Nailor Industries Inc.
  - 8. NCA Manufacturing, Inc.
  - 9. PHL, Inc.
  - 10. Pottorff; a division of PCI Industries, Inc.
  - 11. Prefco; Perfect Air Control, Inc.
  - 12. Ruskin Company.
  - 13. Vent Products Company, Inc.
  - 14. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
  - 15. Limited Enertech.
- B. Type: Static; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm velocity.
- D. Fire Rating: 3 hours.
- E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
- 1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.
  - 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.

- H. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

## 2.5 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ductmate Industries, Inc.
  - 2. Nexus PDQ; Division of Shilco Holdings Inc.
  - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

## 2.6 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ductmate Industries, Inc.
  - 2. Duro Dyne Inc.
  - 3. METALAIRE, Inc.
  - 4. SEMCO Incorporated.
  - 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
  - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

## 2.7 REMOTE DAMPER OPERATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Pottorff; a division of PCI Industries, Inc.
  - 2. Ventfabrics, Inc.
  - 3. Young Regulator Company.
- B. Description: Cable system designed for remote manual damper adjustment.
- C. Tubing: Brass.
- D. Cable: Stainless steel.

## 2.8 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Warming and Ventilating; a division of Mestek, Inc.
  - 2. Cesco Products; a division of Mestek, Inc.
  - 3. Ductmate Industries, Inc.
  - 4. Flexmaster U.S.A., Inc.
  - 5. Greenheck Fan Corporation.
  - 6. McGill AirFlow LLC.
  - 7. Nailor Industries Inc.
  - 8. Pottorff; a division of PCI Industries, Inc.
  - 9. Ventfabrics, Inc.
  - 10. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."
  - 1. Door:
    - a. Double wall, rectangular.
    - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
    - c. Vision panel.
    - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
    - e. Fabricate doors airtight and suitable for duct pressure class.
  - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
  - 3. Number of Hinges and Locks:

- a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
- b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
- c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
- d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

## 2.9 DUCT ACCESS PANEL ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ductmate Industries, Inc.
  - 2. Flame Gard, Inc.
  - 3. 3M.
- B. Labeled according to UL 1978 by an NRTL.
- C. Panel and Frame: Minimum thickness 0.0528-inch carbon or 0.0428-inch stainless steel to match duct material.
- D. Fasteners: Carbon or stainless steel. Panel fasteners shall not penetrate duct wall.
- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
- F. Minimum Pressure Rating: 10-inch wg, positive or negative.

## 2.10 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ductmate Industries, Inc.
  - 2. Duro Dyne Inc.
  - 3. Ventfabrics, Inc.
  - 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
  - 1. Minimum Weight: 26 oz./sq. yd..
  - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
  - 3. Service Temperature: Minus 40 to plus 200 deg F.
  
- F. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
  - 1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
  - 2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  - 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
  - 7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

## 2.11 FLEXIBLE DUCTS

- A. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
  - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
  - 2. Maximum Air Velocity: 4000 fpm.
  - 3. Temperature Range: Minus 10 to plus 160 deg F.
  
- B. Flexible Duct Connectors:
  - 1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

## 2.12 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
  
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## 2.13 DUCT SILENCERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Dynasonic.
  2. Industrial Noise Control, Inc.
  3. McGill AirFlow LLC.
  4. Ruskin Company.
  5. Commercial Acoustics.
  6. Vibro-Acoustics.
- B. General Requirements:
1. Factory fabricated.
  2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
  3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
- C. Shape:
1. Rectangular straight with splitters or baffles.
  2. Round straight with center bodies or pods.
  3. Rectangular elbow with splitters or baffles.
  4. Round elbow with center bodies or pods.
  5. Rectangular transitional with splitters or baffles.
- D. Rectangular Silencer Outer Casing: ASTM A 653/A 653M, G60, galvanized sheet steel, 0.040 inch thick.
- E. Round Silencer Outer Casing: ASTM A 653/A 653M, G60, galvanized sheet steel.
1. Sheet Metal Thickness for Units up to 24 Inches in Diameter: 0.034 inch thick.
  2. Sheet Metal Thickness for Units 26 through 40 Inches in Diameter: 0.040 inch thick.
  3. Sheet Metal Thickness for Units 42 through 52 Inches in Diameter: 0.052 inch thick.
- F. Inner Casing and Baffles: ASTM A 653/A 653M, G60 galvanized sheet metal, 0.034 inch thick, and with 1/8-inch- diameter perforations.
- G. Connection Sizes: Match connecting ductwork unless otherwise indicated.
- H. Principal Sound-Absorbing Mechanism:
1. Controlled impedance membranes and broadly tuned resonators without absorptive media.
  2. Dissipative type with fill material.

- a. Fill Material: Inert and vermin-proof fibrous material, packed under not less than 15 percent compression.
  - b. Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.
- 3. Lining: Fiberglas cloth.
- I. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.
  - 1. Flange connections.
  - 2. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
  - 3. Reinforcement: Cross or trapeze angles for rigid suspension.
- J. Accessories:
  - 1. Factory-installed end caps to prevent contamination during shipping.
  - 2. Removable splitters.
  - 3. Airflow measuring devices.
- K. Source Quality Control: Test according to ASTM E 477.
  - 1. Testing to be witnessed by Architect.
  - 2. Record acoustic ratings, including dynamic insertion loss and generated-noise power levels with an airflow of at least 2000-fpm face velocity.
  - 3. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg static pressure, whichever is greater.
- L. Capacities and Characteristics:
  - 1. Configuration: Straight.
  - 2. Shape: Rectangular.
  - 3. Attenuation Mechanism: Acoustical glass fiber with protective film liner.
  - 4. Maximum Pressure Drop: 0.35-inch wg.
  - 5. Casing:
    - a. Attenuation: Standard.
    - b. Outer Material: Galvanized steel.
    - c. Inner Material: Galvanized steel.
  - 6. Length: See plans.
  - 7. Face Dimension: See plans

## PART 3 - EXECUTION



### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft or control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
- E. Where damper operators occur above non-accessible ceilings, extend operator down to ceiling and terminate with a concealed damper regulator.
- F. Set dampers to fully open position before testing, adjusting, and balancing.
- G. Install test holes at fan inlets and outlets and elsewhere as indicated.
- H. Install fire dampers according to UL listing.
- I. Install opposed-blade volume dampers in each and every zone duct downstream of multi-zone units.
- J. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
  - 1. On both sides of duct coils.
  - 2. Upstream and downstream from duct filters.
  - 3. At outdoor-air intakes and mixed-air plenums.
  - 4. At drain pans and seals.
  - 5. Downstream from all manual volume dampers, control dampers, backdraft dampers, and equipment.
  - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
  - 7. At each change in direction and at maximum 50-foot spacing.
  - 8. Upstream and downstream from turning vanes.
  - 9. Control devices requiring inspection.
  - 10. Elsewhere as indicated.
- K. Install access doors with swing against duct static pressure.

- L. Access Door Sizes:
  - 1. One-Hand or Inspection Access: 8 by 5 inches.
  - 2. Two-Hand Access: 12 by 6 inches.
  - 3. Head and Hand Access: 18 by 10 inches.
  - 4. Head and Shoulders Access: 21 by 14 inches.
  - 5. Body Access: 25 by 14 inches.
  - 6. Body plus Ladder Access: 25 by 17 inches.
- M. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- N. Install flexible connectors to connect ducts to equipment.
- O. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- P. Connect diffusers boots to ducts directly or with maximum 48 inch lengths of flexible duct clamped or strapped in place.
- Q. Connect flexible ducts to metal ducts with draw bands.
- R. Install duct test holes where required for testing and balancing purposes.
- S. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.
- T. Provide airtight and grease tight cleanout doors in kitchen hood exhaust ductwork. Provide at each connection in horizontal ducts, at each elbow, every 20' in straight duct and above every floor in vertical risers.

### 3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Operate dampers to verify full range of movement.
  - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
  - 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
  - 4. Inspect turning vanes for proper and secure installation.
  - 5. Operate remote damper operators to verify full range of movement of operator and damper.

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

- 1. Propeller fans.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on sea level.
- B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

- 1. Certified fan performance curves with system operating conditions indicated.
- 2. Certified fan sound-power ratings.
- 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
- 4. Material thickness and finishes, including color charts.
- 5. Dampers, including housings, linkages, and operators.
- 6. Roof curbs.
- 7. Fan speed controllers.

- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

- 1. Wiring Diagrams: Power, signal, and control wiring.
- 2. Design Calculations: Calculate requirements for selecting vibration isolators.
- 3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

- C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Roof framing and support members relative to duct penetrations.
  - 2. Ceiling suspension assembly members.
  - 3. Size and location of initial access modules for acoustical tile.
  - 4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

#### 1.7 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

## PART 2 - PRODUCTS

### 2.1 WALL MOUNTED VENTILATORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or by one of the following:
  - 1. Acme Engineering & Mfg. Corp.
  - 2. Carnes Company HVAC.
  - 3. Greenheck.
  - 4. Loren Cook Company.
- D. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly and accessories.
- E. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
- F. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- G. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
  - 1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
  - 2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
  - 3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
  - 4. Fan and motor isolated from exhaust airstream.
- H. Accessories:
  - 1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
  - 2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.

### 2.2 PROPELLER FANS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. Acme Engineering & Mfg. Corp.
  - 2. Carnes Company HVAC.
  - 3. Greenheck.
  - 4. Loren Cook Company.
  - 5. Pennbarry.
- C. Description: Direct-driven propeller fans consisting of fan blades, hub, housing, orifice ring, motor, drive assembly, and accessories.
- D. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.
- E. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.
- F. Accessories:
  - 1. Motorized Shutters: Aluminum blades in aluminum frame; interlocked blades with nylon bearings and electric actuator wired to close when fan stops.
  - 2. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
  - 3. Wall Sleeve: Galvanized steel to match fan and accessory size.
  - 4. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

## 2.3 MOTORS

- A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
- B. Enclosure Type: Totally enclosed, fan cooled.

## 2.4 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.
- C. Install units with clearances for service and maintenance.
- D. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

### 3.2 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Verify that shipping, blocking, and bracing are removed.
  - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  - 3. Verify that cleaning and adjusting are complete.
  - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
  - 5. Adjust belt tension.
  - 6. Adjust damper linkages for proper damper operation.
  - 7. Verify lubrication for bearings and other moving parts.
  - 8. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  - 9. Shut unit down and reconnect automatic temperature-control operators.
  - 10. Remove and replace malfunctioning units and retest as specified above.

- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

#### 3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

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PART 1 - GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. HVAC Contractor: Work includes:

- a. Roof hoods.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design ventilators, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.

B. Structural Performance: Ventilators shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of ventilator components, noise or metal fatigue caused by ventilator blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on a uniform pressure of 20 lbf/sq. ft., acting inward or outward.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.

1. Temperature Change (Range): 120 deg F, ambient; material surfaces.

D. Water Entrainment: Limit water penetration through unit to comply with ASHRAE 62.1-2004.

1.3 SUBMITTALS

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

B. Shop Drawings: For gravity ventilators. Include plans, elevations, sections, details, ventilator attachments to curbs, and curb attachments to roof structure.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.

#### 1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
  - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."

#### 1.5 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 zinc coating, mill phosphatized.
- D. Stainless-Steel Sheet: ASTM A 666, Type 304, with No. 4 finish.
- E. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.
  - 1. Use types and sizes to suit unit installation conditions.

#### 2.2 FABRICATION, GENERAL

- A. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.
- B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.

- D. Fabricate supports, anchorages, and accessories required for complete assembly.
- E. Perform shop welding by AWS-certified procedures and personnel.

## 2.3 ROOF HOODS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Acme Engineering & Mfg. Corporation.
  - 2. Carnes.
  - 3. Greenheck Fan Corporation.
  - 4. Loren Cook Company.
  - 5. Pennbarry
- B. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 5-6 and 5-7.
- C. Materials: Aluminum sheet, minimum 0.063-inch- thick base and 0.050-inch- thick hood; suitably reinforced.
- D. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.
  - 1. Configuration: Self-flashing without a cant strip with mounting flange.
  - 2. Overall Height: 12 inches.
- E. Bird Screening: Aluminum, 1/2-inch- square mesh, 0.063-inch wire.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.
- B. Install gravity ventilators with clearances for service and maintenance.
- C. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- D. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Division 07 Section "Joint Sealants" for sealants applied during installation.
- E. Label gravity ventilators according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

- F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- G. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

### 3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories.

### 3.3 ADJUSTING

- A. Adjust damper linkages for proper damper operation.

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PART 1 - GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. HVAC Contractor: Work includes packaged, factory-fabricated and -assembled, gas-fired, fire-tube condensing boilers, trim, and accessories for generating hot water.

1.2 SUBMITTALS

A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work.

1. Design calculations and vibration isolation base details.

- a. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

- b. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails and equipment mounting frames.

2. Wiring Diagrams: Power, signal, and control wiring.

C. Source quality-control test reports.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For boilers to include in emergency, operation, and maintenance manuals.

F. Warranty: Special warranty specified in this Section.

G. Other Informational Submittals:

1. ASME Stamp Certification and Report: Submit "A," "S," or "PP" stamp certificate of authorization, as required by authorities having jurisdiction, and document hydrostatic testing of piping external to boiler.

### 1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
- C. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
- D. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."
- E. UL Compliance: Test boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

### 1.4 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

### 1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Fire-Tube Condensing Boilers:
    - a. Leakage and Materials: 10 years from date of Substantial Completion.
    - b. Heat Exchanger Damaged by Thermal Stress and Corrosion: Prorated for five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers shall verify boilers can be properly installed in available space with proper service access.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Lochinvar.
2. Weil McLain.
3. Raypak X-Fyre H7-850.
4. RBI Futura Fusion.
5. Riello.

## 2.2 HOT WATER BOILER BURNER UNIT (CONDENSING GAS FIRED)

### A. Boiler Design

1. Boiler shall be a compact, single-pass, vertical down-fired Firetube type, with 316 Ti stainless steel tubes, tube sheets, and combustion chamber. The boiler pressure vessel shall be completely insulated with a minimum of 2" of insulation and shall be encased in a sheet metal cabinet with powder coated finish.
2. The tubes shall be 316Ti Stainless Steel and shall be fitted with Aluminum Alloy internal heat transfer fins creating no less than 10 square feet of fireside heating surface per boiler horsepower.
3. The Vessel shall be mounted on a structural steel stand with exhaust gasses collected in a non-corroding drain collection box with drain fitting for draining condensation from the products of combustion. A condensate neutralizing box with limestone chips shall be shipped loose for field installation by the heating contractor.
4. The top tubesheet shall be fully accessible without burner disassembly or removal from the boiler. The burner assembly shall be complete with lifting hinges and pneumatic lifters.
5. Each boiler shall be constructed in accordance with the A.S.M.E. Section IV Code and bear the "H" stamp and shall be manufactured within an ISO 9001 Certified facility to ensure high quality standards.
6. To drain the boiler, a bottom-threaded connection shall be provided at the front of the boiler and field piped by the installing contractor with a manual full size shutoff valve to drain.

### B. Burner Design

1. General: Burner shall be forced draft type. It shall be mounted in and integral with the boiler hinged top door so when the door is opened the burner head, furnace, tubesheet, and tubes are exposed.
2. The burner shall be of the Unitized Venturi, Gas Valve, Blower, and burner head design. This pre-mix design shall utilize a variable speed fan connected to a venturi to simultaneously modulate fuel and air for a minimum a 5:1 turndown ratio. The venturi design shall also act as a method for compensating for changes in barometric pressure, temperature and humidity so the excess air levels are not adversely affected by changes in atmospheric conditions.
3. Burner head shall be constructed of a Fecralloy-metal fiber for solid body radiation of the burner flame. Combustion shall take place on the surface of the burner mantle, which shall be constructed of a woven fecralloy material creating a 360 degree low temperature radiant flame.
4. Emissions: The equipment shall be guaranteed to limit NOx emissions to 20 PPM or less, as certified by an independent testing lab. NOx emission levels shall not be exceeded at

full operating conditions and at designed turndown of the burner. Proof of such emissions certification shall be made available to the engineer and demonstrated at the time of start-up. External flue gas recirculation shall not be accepted for emission control.

5. Gas Train - As a minimum, the gas train shall meet the requirements of CSA and ASME CSD-1 and shall include:
  - a. Low Gas Pressure Interlock, manual reset.
  - b. High Gas Pressure Interlock, manual reset.
  - c. Upstream and downstream manual test cocks.
  - d. Ball Type manual shutoff valve upstream of the main gas valve.
  - e. Unibody double safety gas valve assembly.
  - f. Gas Pressure Regulator
  - g. Union connection to permit burner servicing.
6. Combustion Air Proving Switch shall be furnished to ensure sufficient combustion airflow is present for burner ignition firing.
7. To ensure that proper draft is not blocked in the stack, the burner shall include a High Air Pressure Switch sensing the outlet pressure connection relative to stack back draft.

#### C. Boiler Trim

1. Safety valve(s) shall be ASME Section IV approved side outlet type mounted on the boiler air vent outlet. Size shall be in accordance with code requirements and set to open at 60 psig.
2. Temperature and pressure gauge shall be mounted on the water outlet.
3. Solid State Low water cut-off probe with manual reset and test switch.
4. Manual Reset High Limit Temperature control; range not to exceed 210 F.
5. Outlet water supply sensing probe for operating water limit setpoint.
6. Return water-sensing probe for operating water limit setpoint.
7. Boiler manufacturer shall provide a circulating pump for each boiler specifically sized for the system.

#### D. Boiler Controls

1. The Boiler shall include a Computerized Boiler Burner control which shall be an integrated, solid state digital micro-processing modulating device, complete with sequence indication, fault reset, mode selection, and parameter set-point switches. It shall be mounted at the front of the boiler panel for easy access and viewing. Provide controls for continued heating should the lead or master boiler have a loss of power, one of the remaining boilers shall fire.
2. Controller shall provide for both flame safeguard and boiler control and shall perform the following functions:
  - a. Burner sequencing with safe start check, pre-purge, electronic direct spark ignition, and post purge. Flame rod to prove combustion.
  - b. Flame Supervision. The control shall provide pre-purge and post-purge and shall maintain a running history of operating hours, number of cycles, and the most recent six faults. The control shall be connected to a keyboard display module that will retrieve this information.



- c. Safety Shutdown with display of error.
- d. Modulating control of the variable speed fan for fuel/air input relative to load requirements.
- e. Gas pressure supervision, high and low.
- f. Combustion Air Proving Supervision.
- g. High Air Pressure [back draft too high] Supervision.
- h. The supply temperature and set-point temperature shall be displayed at all times by an LED readout. Output shall be continuous PID via 4 -20 mA current.
- i. Controller shall have an option for communication device to a laptop computer interface for service, troubleshooting, and start-up.
- j. Include the programming of system circulating pump and provide the programming of 2 heating loops.
- k. All parameter input control set-points shall be factory downloaded with jobsite conditions programmed at the time of initial jobsite operation.
- l. All controls to be panel mounted and so located on the boiler as to provide ease of servicing the boiler without disturbing the controls and also located to prevent possible damage by water according to CSA requirements.
- m. Electrical power supply shall be 120 volts, 60 cycle, single phase for the fan and for control circuit requirements.
- n. A sequencing control shall be provided to stage the boilers. The control shall include automatic rotation of lead boiler, an adjustable outdoor reset schedule, multiple setback schedules and a digital display. The control shall force each boiler to low fire, before allowing any boiler to operate at high fire. When all boilers are running, they will then be modulated in unison. The control shall be supplied by the boiler supplier.
- o. Boilers shall be provided with a BACnet interface card for communication and control through the new BAS. Manufacturer shall coordinate available points with the Temperature Control Contractor for control sequence and alarms.

## 2.3 ELECTRICAL POWER

- A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

## 2.4 VENTING KITS

- A. Provide complete system ASTM A959, Type 29-4C stainless steel pipe, vent terminal, thimble, indoor plate, vent adapter, condensate trap, dilution tank and sealant. Acceptable manufacturers include: Z-Flex-Z-Vent III, Heat Fab, Inc. - Saf-T-Vent, Dura-Vent - Fas N Seal and Metal-Fab, Inc. - Corr/Guard. Install vent piping per manufacturer's written instruction.
- B. Combustion-Air Intake: Complete system PVC, Vent terminal with screen, inlet air coupling and sealant. Install per manufacturer's written instructions.

## 2.5 SOURCE QUALITY CONTROL

- A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
- B. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
- C. Allow Using Agency access to source quality-control testing of boilers. Notify Architect 14 days in advance of testing.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.
  - 1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.
- B. Examine mechanical spaces for suitable conditions where boilers will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 BOILER INSTALLATION

- A. Install boilers level on concrete base. Concrete base is specified in Division 23 Section "Common Work Results for HVAC," and concrete materials and installation requirements are specified in Division 03.
- B. Install gas-fired boilers according to NFPA 54.
- C. Assemble and install boiler trim.
- D. Install electrical devices furnished with boiler but not specified to be factory mounted.
- E. Install control wiring to field-mounted electrical devices.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Install piping adjacent to boiler to allow service and maintenance.
- C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
- D. Connect piping to boilers, except safety relief valve connections, with flexible connectors of materials suitable for service. Flexible connectors and their installation are specified in Division 23 Section "Common Work Results for HVAC."
- E. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
- F. Connect hot-water piping to supply- and return-boiler tapings with shutoff valve and union or flange at each connection.
- G. Install piping from safety relief valves to nearest floor drain.
- H. Install piping from safety valves to drip-pan elbow and to nearest floor drain.
- I. Boiler Venting:
  - 1. Install double wall flue venting kit and combustion-air intake.
- J. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- K. Connect wiring according to Division 26 Section "Low Voltage Electrical Power Conductors Cables."

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
  - 1. Perform installation and startup checks according to manufacturer's written instructions.
  - 2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

- a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.
  - b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion , provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Using Agency's maintenance personnel to adjust, operate, and maintain boilers. Refer to Division 01 Section "Demonstration and Training."

END 23 5216

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. HVAC Contractor: Provide and install refrigeration systems as shown on the drawings and as specified herein. Work includes, but is not limited to, the following:

- a. Scroll chiller
- b. Start-up and reports

1.2 RELATED WORK

A. Specified elsewhere:

1. Sections: Architectural / Structural and General Work
2. Division 23 - Mechanical Systems

1.3 QUALITY ASSURANCE

- A. Manufacturers shall be responsible for verifying available power voltage and phase. Contact pertinent utility company and verify that voltage provided is acceptable in every respect, including voltage variations and phase imbalances. All equipment provided on this project shall be fully warranted for operation on available power.
- B. Use only new material and apparatus of the specified design and manufacturer. Furnish all materials in accordance with latest ANSI, AWWA, ASTM, NFPA, ARI, UL standards and other applicable standards or codes. All chillers shall be rated in accord with ARI standards.

1.4 SUBMITTALS

- A. See Architectural Sections for Requirements.

PART 2 - PRODUCTS

2.1 SCROLL CHILLER

- A. Chiller shall be completely factory-packaged including the evaporator, condenser, compressor, motor, lubrication system, control center, and all interconnecting unit piping and wiring.
- B. The initial charge of refrigerant and oil shall be supplied for the chiller.

## 2.2 ACCEPTABLE MANUFACTURERS

- A. Trane.
- B. York.
- C. Carrier.
- D. Daikin Applied

## 2.3 GENERAL UNIT DESCRIPTION

- A. Factory assembled, single-piece chassis, air-cooled liquid chiller. Contained within the package shall be all factory wiring, piping, controls, and refrigerant charge (HFC-410A).

## 2.4 CABINET

- A. Frame shall be heavy-gage, with a powder coated paint finish for both aesthetic appeal and to offer more resistance to corrosion.
- B. Units shall be constructed of a galvanized steel frame with galvanized steel panels and access doors. Component surfaces shall be finished with a powder-coated paint. The coating or paint system shall withstand a 1000-consecutive-hour salt spray application in accordance with standard ASTM B117.

## 2.5 COMPRESSORS

- A. Fully hermetic scroll type compressors with R410A optimized and dedicated scroll profile.
- B. Direct drive motor cooled by suction gas with only three major moving parts and a completely enclosed compression chamber which leads to increased efficiency.
- C. Each compressor will have crankcase heaters installed and properly sized to minimize the amount of liquid refrigerant present in the oil sump during off cycles.

## 2.6 EVAPORATOR

- A. The evaporator shall be a high efficiency, brazed plate-to-plate type heat exchanger consisting of parallel plates. Braze plates shall be stainless steel with copper braze material.
- B. The evaporator shall be protected with an etched foil heater and insulated with 3/4 inch insulation. This combination shall provide freeze protection down to -20F ambient temperatures while the heater is powered. Contractor shall provide separate power to energize heater and protect evaporator while chiller is disconnected.
- C. The water side working pressure shall be rated at 150 psig and tested at 1.5 times maximum allowable water side working pressure.

- D. The refrigerant side working pressure shall be rated at 460 psig (29.6 bars) and tested at 1.1 maximum allowable refrigerant side working pressure.

## 2.7 CONDENSER

- A. The condenser coils shall consist of copper tubes mechanically bonded into plate-type aluminum fins. A subcooling coil shall be an integral part of the main condenser coil.
- B. The maximum allowable working pressure of the condenser shall be 650 psig (44.8 bars). The condensers shall be factory proof and leak tested at 715 psig (49.3 bars).
- C. Low Sound Fans shall be dynamically and statically balanced, direct drive, corrosion resistant glass fiber reinforced composite blades molded into a low noise fan blade.
- D. Low speed fan motors shall be three-phase with permanently lubricated ball bearings and individually protected by circuit breakers.
- E. Unit shall be capable of starting and running at outdoor ambient temperatures from 32F to 125F (0C - 52C) for all sizes.
- F. Provide architectural louvered panels to cover condenser coils and area below the coils.

## 2.8 ENCLOSURES

- A. Mount starters in a UL1995 rated panel for outdoor use.
- B. The starter shall be across-the-line configuration, factory-mounted and fully pre-wired to the compressor motor(s) and control panel.
- C. A control power transformer shall be factory-installed and factory-wired to provide unit control power.
- D. Control panel shall be dead front construction for enhanced service technician safety.
- E. Power line connection type shall be circuit breaker with high fault rated panel.

## 2.9 REFRIGERATION COMPONENTS

- A. Each refrigerant circuit shall include a filter drier, electronic expansion valve with site glass, liquid line service valves and a complete operating charge of both refrigerant HFC-410A and compressor oil.
- B. Each refrigerant circuit shall include a discharge line service valve to allow the refrigerant to be isolated in the condenser.

## 2.10 CONTROLS, SAFETIES AND DIAGNOSTICS

- A. The microprocessor-based unit controller shall be factory-installed and factory-tested.

- B. The unit display shall provide the following data:
  1. Water and air temperatures
  2. Refrigerant levels and temperatures
  3. Flow switch status
  4. Compressor starts and run times
- C. The unit controller shall provide chilled water reset based on return water as an energy saving option.
- D. The unit shall shut down if one or more of the following safeties has been breached:
  1. Low evaporator refrigerant temperature and/or pressure
  2. High condenser refrigerant pressure
  3. Low oil flow
  4. Motor current overload
  5. High compressor discharge temperature
  6. Electronic distribution faults: phase loss, phase imbalance, or phase reversal
- E. Unit shall be shipped with factory control and power wiring installed.
- F. Provide BACnet MSTP interface card

#### 2.11 Chilled Fluid Circuit

- A. Chilled fluid circuit shall be rated for 150 psig (1034 kPa) working pressure.
- B. Proof of flow switch shall be provided by the equipment manufacturer and installed the correct number of pipe diameters from any elbow and in the correct orientation.
- C. Units with brazed plate evaporators shall have a water strainer that is factory provided. It shall be installed with a blow down valve to facilitate periodic cleaning of the strainer to prevent it from becoming clogged.

#### 2.12 ACCESSORIES AND OPTIONS FOR ROTARY CHILLER

- A. Some accessories and options supersede standard product features. All options are factory-mounted unless otherwise noted.
- B. General Options:
  1. Flow Switch: Vapor proof SPDT, NEMA 3R switch, 150 psig (10.3 barg), -20°F to 250°F (-28.9°C to 121.1°C). (Field Mounted by Contractor)
  2. Unit shall have internal vibration isolation.
  3. Hail guards for coil protection.
  4. Low noises fans, factory installed sound attenuators. Maximum sound power listed below.
  5. Single point fused disconnect,
  6. Three years parts, labor and refrigerant warranty. Warranty shall cover complete unit.



7. Refrigerant isolation valves.
8. High efficiency chiller, ASHRAE 90.1 compliant, AHRI certified.
9. Removable screens, single ply to protect coils from leaves, cotton wood seed, litter debris, etc.

## PART 3 - EXECUTION

### 3.1 MANUFACTURER'S FIELD SERVICES

- A. OEM Startup is performed by factory trained and authorized servicing technicians confirming equipment has been correctly installed and passes specification checklist prior to equipment becoming operational and covered under OEM warranty.
  1. Included OEM Factory Startup:
    - a. Centrifugal, Rotary Screw, and Scroll Chillers
- B. Applied Chiller manufacturers shall maintain service capabilities no more than 100 miles from the jobsite.
- C. The manufacturer shall furnish complete submittal wiring diagrams of the package unit as applicable for field maintenance.

END 23 6500

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Base Bid

1. HVAC Contractor: Provide and install air handling systems as shown on the drawings and as specified. Work includes, but is not limited to, the following:
  - a. Air handling units and rooftop units
  - b. Fans and accessories

B. Work Not Included:

1. Materials, equipment or final connections to items of equipment specified or noted on the drawings to be furnished or executed under another contract.

1.2 RELATED WORK

A. Specified elsewhere:

1. Sections: Architectural / Structural and General Work
2. Division 23 - Mechanical Systems

1.3 QUALITY ASSURANCE

- A. Use only new material and apparatus of the specified design and manufacturer. Furnish all materials in accordance with latest ANSI, ASTM, NFPA, AMCA, SMACNA, ASHRAE, UL, MICA, AABC, ARI, ADC standards and other applicable standards or codes.

1.4 SUBMITTALS

- A. See Architectural Sections for requirements.

PART 2 - PRODUCTS

2.1 AIR HANDLING UNITS AND ROOFTOP UNITS

A. Unit Casing

1. Unit manufacturer shall ship unit in segments as specified by the contractor for ease of installation in tight spaces. The entire air handler shall be constructed of galvanized steel. Casing finished to meet ASTM B117 250-hour salt-spray test. The removal of access panels or access doors shall not affect the structural integrity of the unit. All removable panels shall be gasketed. All doors shall have gasketing around full perimeter to prevent air leakage. Contractor shall be

responsible to provide connection flanges and all other framework that is needed to properly support the unit.

2. Casing performance - Casing air leakage shall not exceed leak class 6 (CL = 6) per ASHRAE 111 at specified casing pressure, where maximum casing leakage (cfm/100 ft<sup>2</sup> of casing surface area) = CL X P<sup>0.65</sup>.
3. Air leakage shall be determined at 1.00 times maximum casing static pressure up to 8 inches w.g. Specified air leakage shall be accomplished without the use of caulk. Total estimated air leakage shall be reported for each unit in CFM, as a percentage of supply air, and as an ASHRAE 111 Leakage Class.
4. Under 55F supply air temperature and design conditions on the exterior of the unit of 81F dry bulb and 73F wet bulb, condensation shall not form on the casing exterior. The AHU manufacturer shall provide tested casing thermal performance for the scheduled supply air temperature plotted on a psychrometric chart. The design condition on the exterior of the unit shall also be plotted on the chart. If tested casing thermal data is not available, AHU manufacturer shall provide, in writing to the Engineer and Owner, a guarantee against condensation forming on the unit exterior at the stated design conditions above. The guarantee shall note that the AHU manufacturer will cover all expenses associated with modifying units in the field should external condensate form on them. In lieu of AHU manufacturer providing a written guarantee, the installing contractor must provide additional external insulation on AHU to prevent condensation.
5. Unit casing (wall/floor/roof panels and doors) shall be able to withstand up to 1.5 times design static pressure, or 8-inch w.g., whichever is less, and shall not exceed 0.0042 per inch of panel span (L/240).
6. Floor panels shall have tread plate flooring - aluminum tread plate minimum 0.125".
7. Unit casing panels shall be 2-inch double-wall construction, with solid galvanized exterior and solid galvanized interior, to facilitate cleaning of unit interior.
8. Unit casing panels (roof, walls, floor) and doors shall be provided with a minimum thermal resistance (R-value) of 13 Hr\*Ft<sup>2</sup>\*°F/BTU.
9. Unit casing panels (roof, walls, floor) and external structural frame members shall be completely insulated filling the entire panel cavity in all directions so that no voids exist. Panel insulation shall comply with NFPA 90A.
10. Casing panel inner liners must not extend to the exterior of the unit or contact the exterior frame. A mid-span, no-through-metal, internal thermal break shall be provided for all unit casing panels.
11. Access panels and/or access doors shall be provided in all sections to allow easy access to drain pan, coil(s), motor, drive components and bearings for cleaning, inspection, and maintenance.
12. Access panels and doors shall be fully removable without the use of specialized tools to allow complete access of interior surfaces.
13. The fan section and discharge plenum section shall have 2" of additional insulation and perforated liner for sound attenuation.

#### B. Access Doors

1. Access doors shall be 2-inch double-wall construction. Interior and exterior shall be of the same construction as the interior and exterior wall panels.
2. All doors downstream of the cooling coil shall be provided with a thermal break construction of door panel and door frame.

3. Gasketing shall be provided around the full perimeter of the doors to prevent air leakage.
4. Door hardware shall be surface-mounted to prevent through-cabinet penetrations that could likely weaken the casing leakage and thermal performance.
5. Handle hardware shall be designed to prevent unintended closure.
6. Access doors shall be hinged and removable without the use of specialized tools to allow.
7. Hinges shall be interchangeable with the door handle hardware to allow for alternating door swing in the field to minimize access interference due to unforeseen job site obstructions.
8. Door handle hardware shall be adjustable and visually indicate locking position of door latch external to the section.
9. All doors shall be a 60-inch high when sufficient unit height is available, or the maximum height allowed by the unit height.
10. Multiple door handles shall be provided for each latching point of the door necessary to maintain the specified air leakage integrity of the unit.

C. Primary Drain Pans

1. All cooling coil sections shall be provided with an insulated, double-wall, stainless steel drain pan.
2. The drain pan shall be designed in accordance with ASHRAE 62.1 being of sufficient size to collect all condensation produced from the coil and sloped in two planes, pitched toward drain connections, promoting positive drainage to eliminate stagnant water conditions when unit is installed level and trapped per manufacturer's requirements. See section 2.07, paragraph F through H for specifications on intermediate drain pans between cooling coils.
3. The outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition.
4. All drain pan threaded connections shall be visible external to the unit. Threaded connections under the unit floor shall not be accepted.
5. Drain connections shall be of the same material as the primary drain pan and shall extend a minimum 2-1/2-inch beyond the base to ensure adequate room for field piping of condensate traps.
6. The installing contractor is responsible to ensure the unit is installed level, trapped in accordance with the manufacturer's requirements, and visually inspected to ensure proper drainage of condensate.
7. Coil support members inside the drain pan shall be of the same material as the drain pan and coil casing.
8. If drain pans are required for heating coils, access sections, or mixing sections they will be indicated in the plans.

D. Fans

1. Fan sections shall have a minimum of one hinged and latched access door located on the drive side of the unit to allow inspection and maintenance of the fan, motor, and drive components. Construct door(s) per Section 2.04.

2. Provide fans of type and class as specified on the schedule. Fan shafts shall be solid steel, coated with a rust-inhibiting coating, and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM. All fans shall be statically and dynamically tested by the manufacturer for vibration and alignment as an assembly at the operating RPM to meet design specifications. Fans controlled by variable frequency drives shall be statically and dynamically tested for vibration and alignment at speeds between 25% and 100% of design RPM. If fans are not factory-tested for vibration and alignment, the contractor shall be responsible for cost and labor associated with field balancing and certified vibration performance. Fan wheels shall be keyed to fan shafts to prevent slipping.
3. All fans, including direct drive plenum fans, shall be mounted on isolation bases. Internally-mounted motor shall be on the same isolation base. Fan and motor shall be internally isolated with spring isolators. Unit sizes up to a nominal 4,000 CFM shall have 1-inch spring isolation. Units with nominal CFM's higher than 4,000 shall have 2-inch springs. A flexible connection (e.g. canvas duct) shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor in order to avoid transmission of noise and vibration through the ductwork and building structure.

E. Motors and Drives

1. All motors and drives shall be factory-installed and run tested. All motors shall be installed on a slide base to permit adjustment of belt tension. Slide base shall be designed to accept all motor sizes offered by the air-handler manufacturer for that fan size to allow a motor change in the future, should airflow requirements change. Fan sections without factory-installed motors shall have motors field installed by the contractor. The contractor shall be responsible for all costs associated with installation of motor and drive, alignment of sheaves and belts, run testing of the motor, and balancing of the assembly.
2. Motors shall meet or exceed all NEMA Standards Publication MG 1 - 2006 requirements and comply with NEMA Premium efficiency levels when applicable. Motors shall comply with applicable requirements of NEC and shall be UL Listed.
3. Fan Motors shall be heavy duty, open drip-proof operable at 460 volts, 60Hz, 3-phase. If applicable, motor efficiency shall meet or exceed NEMA Premium efficiencies.
4. Direct driven fans shall use 2-pole (3600 rpm), 4-pole (1800 rpm) or 6-pole (1200 rpm) motors, NEMA Design B, with Class B insulation capable to operate continuously at 104 deg F (40 deg C) without tripping overloads.
5. Motors shall have a +/- 10 percent voltage utilization range to protect against voltage variation.
6. Manufacturer shall provide for each fan a nameplate with the following information to assist air balance contractor in start up and service personnel in maintenance. Fan and motor sheave part number. Fan and motor bushing part number. Number of belts and belt part numbers. Fan design RPM and motor HP. Belt tension and deflection. Center distance between shafts

## F. Coils

1. Coils section header end panel shall be removable to allow for removal and replacement of coils without impacting the structural integrity of the unit.
2. Install coils such that headers and return bends are enclosed by unit casing to ensure that if condensate forms on the header or return bends, it is captured by the drain pan under the coil.
3. Coils shall be manufactured with plate fins to minimize water carryover and maximize airside thermal efficiency. Fin tube holes shall have drawn and belled collars to maintain consistent fin spacing to ensure performance and air pressure drop across the coil as scheduled. Tubes shall be mechanically expanded and bonded to fin collars for maximum thermal conductivity. Use of soldering or tinning during the fin-to-tube bonding process is not acceptable due to the inherent thermal stress and possible loss of bonding at that joint.
4. Construct coil casings of galvanized steel. End supports and tube sheets shall have belled tube holes to minimize wear of the tube wall during thermal expansion and contraction of the tube.
5. All coils shall be completely cleaned prior to installation into the air handling unit. Complete fin bundle in direction of airflow shall be degreased and steam cleaned to remove any lubricants used in the manufacturing of the fins, or dirt that may have accumulated, in order to minimize the chance for water carryover.
6. ½" tube coils shall have minimum tube thickness of 0.025" and 5/8" tubes shall have minimum tube thickness of 0.024".
7. When two or more cooling coils are stacked in the unit, an intermediate drain pan shall be installed between each coil. The intermediate drain pan shall be designed being of sufficient size to collect all condensation produced from the coil and sloped to promote positive drainage to eliminate stagnant water conditions. The intermediate drain pan shall be constructed of the same material as the sections primary drain pan.
8. The intermediate drain pan shall begin at the leading face of the water-producing device and be of sufficient length extending downstream to prevent condensate from passing through the air stream of the lower coil.
9. Intermediate drain pan shall include downspouts to direct condensate to the primary drain pan. The intermediate drain pan outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition.

## G. Filters

1. Provide factory-fabricated filter section of the same construction and finish as unit casings. Filter section shall have side access filter guides and access door(s) extending the full height of the casing to facilitate filter removal. Construct doors in accordance with Section 2.04. Provide fixed filter blockoffs as required to prevent air bypass around filters. Blockoffs shall not need to be removed during filter replacement. Filters to be of size, and quantity needed to maximize filter face area of each particular unit size.
2. Filter type, MERV rating, and arrangement shall be provided as defined in project plans and schedule
3. Manufacturer shall provide one set of startup filters. Provide two additional sets of filters. One set shall be installed at the completion of the project and the third

set shall be turned over to the Owner as a replacement set. Provide an exterior pressure gauge at the unit to check pressure drop across filters.

H. Dampers

1. All dampers, with the exception of external bypass and multizones (if scheduled), shall be internally mounted. Dampers shall be premium ultra low leak and located as indicated on the schedule and plans. Blade arrangement (parallel or opposed) shall be provided as indicated on the schedule and drawings. Dampers shall be Ruskin CD60 double-skin airfoil design or equivalent for minimal air leakage and pressure drop. Leakage rate shall not exceed 4 CFM/square foot at one inch water gauge complying with ASHRAE 90.1 maximum damper leakage and shall be AMCA licensed for Class 1A. All leakage testing and pressure ratings shall be based on AMCA Standard 500-D. Manufacturer shall submit brand and model of damper(s) being furnished, if not Ruskin CD60.

I. Hood Inlet

1. Inlet hoods for each outside damper shall be provided with a high performance sine-wave moisture eliminator to prevent entrainment of water into the unit from outside air. Wire mesh screens shall not be acceptable as a moisture eliminator. Exhaust hoods shall be provided on exhaust air openings.

J. Discharge Plenum Sections

1. Plenums shall be provided as indicated in the schedule and plans to efficiently turn air and provide acoustical attenuation. Discharge plenum opening types and sizes shall be scaled to meet pressure drop requirements scheduled and align with duct takeoffs. Provide additional 2" insulation and perforated liner for sound attenuation.
2. Provide grating over bottom opening for the unit.

K. Marine Lights

1. Marine lights shall be provided throughout AHUs as indicated on the schedule and plans. Lights shall be instant-on, light-emitting diode (LED) type to minimize amperage draw and shall produce lumens equivalent to a minimum 75W incandescent bulb (1200 lumens). LED lighting shall provide instant-on, white light and have a minimum 50,000 hr life.
2. Light fixture shall be weather-resistant, enclosed and gasketed to prevent water and dust intrusion.
3. Fixtures shall be designed for flexible positioning during maintenance and service activities for best possible location providing full light on work surface of interest and not being blocked by technician.
4. All lights on a unit shall be wired in the factory to a single on-off switch.
5. Installing contractor shall be responsible for providing 115V supply to the factory-mounted marine light circuit (unless single-point power is specified to be provided by AHU manufacturer).

L. Convenience Outlets

1. A 15-amp, 115V GFCI convenience outlet shall be provided by the AHU manufacturer. The outlet shall be separate from the load side of the equipment per NEC requirements. Installing contractor shall be responsible for providing 115V supply to the factory-mounted GFCI outlet circuit per NEC (even when single-point power is specified to be provided by AHU manufacturer).

M. Variable Frequency Drives (VFDs)

1. RTU VFDs to be factory installed. AHU variable frequency drives shall be provided, mounted, and wired by the Temperature Control Contractor as indicated on the schedule and drawings. All standard and optional features shall be included within the VFD enclosure, unless otherwise specified. The VFDs shall be UL listed. The listing shall allow mounting in plenum or other air handling compartments. Acceptable VFD manufacturers include: ABB, Square D and Dan Foss.
2. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to eliminate the need for motor derating.
3. With the motor's rated voltage applied to the VFD input, the VFD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor. VFDs utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors will not draw more than full load current during full load and full speed operation.
4. The VFD shall include an input full-wave bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.
5. The VFD and options shall be tested to ANSI/UL Standard 508. The complete VFD, including all specified options, shall be assembled by the manufacturer, which shall be UL 508 certified for the building and assembly of option panels. Assembly of separate panels with options by a third-party is not acceptable. The appropriate UL stickers shall be applied to both the VFD and option panel, in the case where these are not contained in one panel.
6. The VFD shall have DC link reactors on both the positive and negative rails of the DC bus to minimize power line harmonics. VFDs without DC link reactors shall provide a minimum 3% impedance line reactor.
7. The VFDs full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.
8. The VFD shall be able to provide full torque at any selected frequency from 28 Hz to base speed to allow driving direct drive fans without derating.
9. An automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continually monitor the motor's speed and load and adjust the applied voltage to maximize energy savings and provide up to an additional 3% to 10% energy savings.



10. Input and output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD. Switching rate may be up to 1 time per minute on the input and unlimited on the output.
11. An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to run the test.
12. Galvanic and/or optical isolation shall be provided between the VFDs power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDs not including either galvanic or optical isolation on both analog I/O and discrete I/O shall include additional isolation modules.
13. The VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD efficiencies while reducing motor noise.
14. Protective Features
  - a. Protection shall be provided against input transients, loss of AC line phase, output short circuit, output ground fault, overvoltage, undervoltage, VFD overtemperature and motor overtemperature. The VFD shall display all faults as words. Codes are not acceptable.
  - b. The VFD shall be protected from sustained power or phase loss. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD shall continue to operate with reduced output with an input voltage as low as 164 V AC for 208/230 volt units, 313 V AC for 460 volt units, and 394 volts for 600 volts units.
  - c. The VFD shall incorporate a motor preheat circuit to keep the motor warm and prevent condensation build up in the stator.
  - d. The VFD package shall include semi-conductor rated input fuses to protect power components.
  - e. To prevent breakdown of the motor winding insulation, the VFD shall be designed to comply with IEC Part 34-17. Otherwise the AHU manufacturer shall ensure that inverter rated motors are supplied.
  - f. The VFD shall include a "signal loss detection" circuit to sense the loss of an analog input signal such as 4 to 20 mA or 2 to 10 V DC, and shall be programmable to react as desired in such an instance.
  - g. The VFD shall function normally when the keypad is removed while the VFD is running and continue to follow remote commands. No warnings or alarms shall be issued as a result of removing the keypad.
  - h. The VFD shall catch a rotating motor operating forward or reverse up to full speed.
  - i. The VFD shall be rated for 100,000 amp interrupting capacity (AIC).
  - j. The VFD shall include current sensors on all three output phases to detect and report phase loss to the motor. The VFD shall identify which of the output phases is low or lost.
  - k. The VFD shall continue to operate without faulting until input voltage reaches 300 V AC on 208/230 volt units, 539 V AC on 460 volt units, and 690 volts on 600 volt units.

## 15. Interface Features

- a. Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the VFD and determine the speed reference. On units with bypass, a VFD/Off/Bypass selector switch shall be provided.
- b. The VFD shall be able to be programmed to provide a 24 V DC output signal to indicate that the VFD is in Auto/Remote mode.
- c. The VFD shall provide digital manual speed control. Potentiometers are not acceptable.
- d. A lockable, alphanumeric backlit display keypad shall be provided. The keypad shall be remotely mountable up to 10 feet away using standard 9-pin cable.
- e. The keypads for all sizes of VFDs shall be identical and interchangeable.
- f. To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFDs keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters.
- g. The display shall be programmable to display in English, Spanish and French at a minimum.
- h. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.
- i. A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD eliminating the need for macros.
- j. The VFD shall include a standard EIA-485 communications port and capabilities to be connected at a future date to a Johnson Controls N2 Metasys or Siemens FLN system at no additional cost to the owner. The connection shall be software selectable by the user.
- k. At a minimum, the following points shall be controlled and/or accessible:
  - (1) VFD Start/Stop
  - (2) Speed reference
  - (3) Fault diagnostics
  - (4) Meter points
    - (a) Motor power in HP
    - (b) Motor power in kW
    - (c) Motor kW-hr
    - (d) Motor current
    - (e) Motor voltage
    - (f) Hours run
    - (g) 2 feedback signals
    - (h) DC link voltage
    - (i) Thermal load on motor
    - (j) Thermal load on VFD
    - (k) Heatsink temperature
- l. Four additional Form C 230 volt programmable relays shall be available for field installation within the VFD

- m. Two set-point control interfaces (PID control) shall be standard in the unit. The VFD shall be able to look at two feedback signals, compare with two set-points and make various process control decisions.
- n. Floating point control interface shall be provided to increase/decrease speed in response to contact closures.
- o. Four simultaneous displays shall be available. They shall include frequency or speed, run time, output amps and output power. VFDs unable to show these four displays simultaneously shall provide panel meters.
- p. Sleep mode shall be provided to automatically stop the VFD when its speed drops below set sleep level for a specified time. The VFD shall automatically restart when the speed command exceeds the set wake level.
- q. The sleep mode shall be functional in both follower mode and PID mode.
- r. A run permissive circuit shall be provided to accept a "system ready" signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.
- s. The following displays shall be accessible from the control panel in actual units: Reference Signal Value, Output Frequency in Hz or percent, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, DC Bus Voltage, VFD Temperature in degrees, and unit CFM.
- t. The display shall be programmed to read in inches of water column (in-wg).
- u. The VFD shall be able to be programmed to sense the loss of load and signal a no load/broken belt warning or fault.
- v. If the temperature of the VFDs heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. If the temperature of the heat sink continues to rise the VFD shall automatically reduce its output frequency to the motor. As the VFDs heat sink temperature returns to normal, the VFD shall automatically increase the output frequency to the motor and return the carrier frequency to its normal switching speed.
- w. The VFD shall have temperature controlled cooling fans for quiet operation and minimized losses.
- x. The VFD shall store in memory the last 10 faults and related operational data.
- y. Eight programmable digital inputs shall be provided for interfacing with the systems control and safety interlock circuitry.
- z. Two programmable relay outputs, one Form C 240 V AC, one Form A 30 V AC, shall be provided for remote indication of VFD status.
- aa. Three programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include two voltage (0 to 10 V DC, 2 to 10 V DC) and one current (0 to 20 mA, 4 to 20 mA) input.
- bb. Two programmable 0 to 20 mA analog outputs shall be provided for indication of VFD status. These outputs shall be programmable for

output speed, frequency, current and power. They shall also be programmable to provide a selected 24V DC status indication.

- cc. Under fire mode conditions, the VFD shall be able to be programmed to automatically default to a preset speed.

#### 16. Adjustments

- a. The VFD shall have an adjustable carrier frequency in steps of not less than 0.1 kHz to allow tuning the VFD to the motor.
- b. A minimum of sixteen preset speeds shall be provided.
- c. Four acceleration and four deceleration ramps shall be provided. Accel and decel time shall be adjustable over the range from 0 to 3,600 seconds to base speed. The shape of these curves shall be automatically contoured to ensure no-trip acceleration and deceleration.
- d. Four current limit settings shall be provided.
- e. If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: undervoltage, overvoltage, current limit and inverter overload.
- f. The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.
- g. An automatic  $\zeta$ on delay shall be selectable from 0 to 120 seconds.

#### 17. Service Conditions

- a. VFDs shall provide full output in an ambient temperature from -10 to 50°C (14 to 104°F).
- b. VFDs shall provide full output in a relative humidity from 0 to 95%, non-condensing.
- c. VFDs shall provide full output up to 3,300 feet elevation without derating.
- d. VFDs shall provide full output with an AC line voltage variation from -10 to +10% of nominal voltage.
- e. No side clearance shall be required for cooling of any units. All power and control wiring shall be done from the bottom.

#### 18. Warranty

- a. The VFD shall be warranted by the manufacturer for a period of 42 months from date of shipment, or 36 months from start-up, which ever occurs first. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory-authorized on-site service.

#### N. Factory Wiring of Lights, VFDs, and Combination Starters/Disconnects

- 1. VFDs shall be wired per NEC, UL, and NFPA 90A requirements. Units with factory-mounted controls shall also include power wiring from the VFD or starter/disconnect control transformer to the control system transformers. Units

with VFDs and factory-mounted controls shall have a binary start-stop signal and an analog speed signal wired from the direct digital controller to the VFD.

2. All power wiring for voltages greater than 24V and traveling through multiple unit sections shall be contained in an enclosed, metal, power-wiring raceway or EMT. Sections less than 6-inch in length may be contained in FMC.
3. The Temperature Control Contractor and RTU Manufacturer Service Technician shall unit for proper operation and fan rotation.
4. For fan motors not supplied with a factory mounted and wired starter or VFD, the unit manufacturer shall supply a 4 X 4 NEMA 4 junction box on the exterior of the fan section(s) with wiring, prewired to the fan motor, to allow for ease of field installation of a starter or VFD.
5. On units provided with factory mounted and wired supply fan starter or VFD and DDC controls, the manufacturer shall provide a single point of power. Line-to-24v transformers shall be provided with sufficient vA to power the unit mounted controller and factory installed control points.

O. Acceptable Manufacturers

1. Trane
2. York Solution YC
3. Carrier 39CC
4. Daikin Applied Skyline Series

P. Warranty

1. Provide comprehensive 3-year warranty including parts and labor.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install all equipment per manufacturer's printed recommendations.

### 3.2 EXAMINATION

- A. Verify that roof is ready to receive work.
- B. Verify that proper power supply is available.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Mount units on factory built roof mounting frame providing watertight enclosure to protect ductwork. Install roof mounting curb level.

### 3.4 MANUFACTURER'S FIELD SERVICES

- A. Package rooftop unitary manufacturers shall maintain service capabilities no more than 100 miles from the jobsite.

- B. The manufacturer shall furnish complete submittal wiring diagrams of the package unit as applicable for field maintenance and service.

END 23 8500

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section includes:
  - 1. Electrical equipment coordination and installation.
  - 2. Common electrical installation requirements.

PART 2 - PRODUCTS – DOES NOT APPLY

PART 3 - EXECUTION

3.1 INSPECTION OF BID DOCUMENTS AND PREMISES

- A. Visit the premises, take measurements and verify all elevations shown on the drawings, inspect existing conditions and limitations, obtain first hand information necessary to submit a complete bid.
- B. Thoroughly examine the complete set of contract documents including work required by other trades. Bidders are cautioned to acquaint themselves with requirements necessitating installation work of material or equipment furnished by other contractors or the Owner.
- C. In the event of any conflict, discrepancy or inconsistency among the Contract Documents, interpretation shall be based on the following descending order or priority:
  - 1. Specifications.
  - 2. Drawings, and among the drawings, the following:
    - a. as between figures given on drawings and scaled measurements, the figures shall govern;
    - b. as between large scale drawings and small scale drawings, the large scale drawings shall govern.

3. In the event that Work is called for by the drawings but not by the specifications, or by the specifications but not by the drawings, the Contractor shall be responsible for such Work.

### 3.2 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
  1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  3. To allow right of way for piping and conduit installed at required slope.
  4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

### 3.3 INTERRUPTION OF ELECTRICAL SYSTEMS AND SERVICES

- A. Do not interrupt electric systems or service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  1. Notify Architect or Owner no fewer than seven days in advance of proposed interruption of electrical service. Indicate:
    - a. The extent of the work to be done during the outage.
    - b. Probable length of time required for the outage.
    - c. Designed time at which the outage is to begin.
  2. Do not proceed with interruption of electrical service without Architect's or Owner's written permission.
  3. Schedule work to minimize the number and length of time of the outage(s) or interruption(s) of the various systems and services.

### 3.4 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.



- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Space Preference:
  - 1. Carefully verify and coordinate the location and level of all lines. Run preliminary levels and check with all other contractors so that conflict in location may be avoided.
  - 2. If conflicts occur, the following preference schedule shall be followed:
    - a. Recessed electric fixtures.
    - b. High pressure ductwork.
    - c. Sanitary drainage.
    - d. Steam condensate, hot and chilled water.
    - e. Low pressure ductwork.
    - f. Domestic water storm and vent lines.
    - g. Electric conduits.
  - 3. No other work shall have preference over plumbing lines below fixtures.
  - 4. No other work shall have preference over conduit above or below electric switchgear and above or below panels.
  - 5. No piping conveying fluids shall be provided directly over electrical or elevator equipment.
- F. Lines and Levels: Determine all grades, maintain necessary lines and levels throughout the progress of the work and assume full responsibility for their correctness. Where levels are indicated on the drawings, work shall be installed at those levels unless prior written approval to change is obtained from the Architect / Engineer.
- G. Location of Equipment: The approximate location of all equipment is shown on the drawings. The Architect / Engineer reserves the right to change the location of all equipment 5' in any direction without these changes being made the subject of an extra charge provided such changes are made before final installation.

### 3.5 ELECTRICAL DEMOLITION

- A. Disconnect and remove electrical systems, equipment and components indicated to be removed.
  - 1. Wiring Devices to be Removed: Remove wiring devices indicated to be removed along with associated cover plates.
  - 2. Electrical Equipment to be Removed: Remove electrical equipment indicated to be removed along with associated supports, fittings, raceways and conductors.
  - 3. Motors and Mechanical Equipment to be Removed: Electrically disconnect each motor and piece of mechanical equipment indicated to be removed and remove associated raceways, conduits, devices and electrical equipment.

4. Feeders and Branch Circuits to be Removed: Remove feeders and branch circuits indicated to be removed along with associated supports, fittings, raceway and conductors.
- B. All removed electrical equipment, devices, raceways, conductors and associated items, except as noted below, shall become property of the Contractor and shall be properly disposed of by the Contractor.
- C. Removal of existing electrical devices shall be such that all existing remaining electrical devices are kept in continuous service.
- D. Existing circuit conductors connected to outlets, boxes or fixtures being removed shall be disconnected and removed back to next active remaining device.
- E. Existing circuit conductors connected to other fixtures, devices or other electrical equipment that are not to be removed or disconnected and are passing through outlet boxes, fixtures and conduit that are being removed; shall be rerouted from remaining existing device to next remaining device as necessary to keep remaining devices in service and existing circuit conductors continuous.
- F. Where connections of existing devices cannot be made continuous with existing conduit, boxes and conductors; new raceways and conductors shall be installed from existing remaining device to next remaining device.
- G. For each item disconnected and removed, disconnect and remove defunct circuit wiring back to next active remaining device or to panel or switchboard from which the circuit originates.
- H. For each item disconnected and removed, disconnect and remove abandoned, exposed conduits, and / or conduits made exposed by demolition, back to next active remaining device or to panel or switchboard from which the circuit originates.
- I. All conditions shall be carefully field determined and verified.
- J. Provide all abandoned ceiling outlets, switch boxes and outlet boxes with blank coverplates.

### 3.6 CUTTING AND PATCHING

- A. Examine architectural and structural drawings to determine the general nature of the types of construction to be encountered during performance of electrical work.
- B. All cutting and patching of masonry, carpentry, steel, iron work, concrete structural work, and finished surfaces belonging to the building shall be done in order that work may be properly installed. Replace or repair all disturbed constructions or finishes to its original condition and under no condition cut structural work except upon approval of the Architect / Engineer.
- C. Cut through ceilings, floors, walls and partitions in a careful manner and fill the openings around the pipes and sleeves.

- D. Carefully coordinate locations of openings and sleeves to avoid conflict with other trades. Furnish complete information concerning locations and sizes of openings to other trades in sufficient time for inclusion on their shop drawings.
- E. Employ craftsmen and mechanics who are skilled and experienced in their respective trades to perform all cutting, fitting, matching, patch repairing, and finishing work required for installation of electrical work.
- F. Perform cutting to neat line, in a manner that will not weaken the wall, partition, or floor being cut. Cut holes in floors to neat line. Perform drilling in a manner that will not cause breaking of floor around the drilled hole.
- G. General Contractor shall patch, repair and unify all work and material that is cut.

### 3.7 OPENINGS IN EXISTING CONSTRUCTION

- A. In existing construction, perform all cutting and patching where required in connection with the work. Match patching to existing adjacent surfaces.
- B. All cutting in existing structural elements of building shall be accomplished with hole saws. Air hammers and cutting torches are not permitted.
- C. Reinforced concrete slabs, steel joists, concrete floors and footings, or other structural work shall not be cut or disturbed in any way, unless as approved by the Architect / Engineer. The Electrical Contractor shall be held responsible for and correct all damage that he may cause.
- D. Openings between conduit and floors or walls through fire or smoke barriers shall be closed with fire stop material to maintain fire or smoke barrier rating.
- E. Fire stop material shall be Dow Corning 3-6548 Silicone RTV Foam, Chase Technology Corp. CTC PR-855 fire-resistant foam sealant, 3M CP-25 Series Caulk Fire Barrier, T & B S-101 Fire Barrier or Nelson Flameseal.

### 3.8 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly.

### 3.9 FIREPROOFING REPAIR

- A. Install all hangers, inserts, supports, anchorages, etc., prior to installation of fireproofing materials. Do not remove or damage fireproofing on roof deck, roof beams, roof framing, floor beams of other floor framing members, columns, or wind bracing during installation of any electrical work. If fireproofing is damaged or is removed, repair or replace to satisfaction of Architect / Engineer and at no additional expense to Owner.

3.10 FIELD CORRECTIONS AND CHANGES

- A. Carefully and accurately record on field set of drawings, any deviations or changes in locations of conduit, wiring and/or equipment made in the field and shall keep the Architect / Engineer informed on all deviations and changes.
- B. At the completion of the job, furnish the Architect / Engineer three (3) complete sets (not the field set) of drawings indicating these deviations or changes. Extra sets of drawings will be provided to the contractor for this purpose. Any changes in the exterior work shall be recorded by dimension.

3.11 OPERATION AND MAINTENANCE INSTRUCTIONS

- A. Before final acceptance of the electrical installation, provide to the Architect / Engineer three (3) bound copies of a complete set of operating and maintenance instructions and procedures for all electrical systems and equipment furnished under this contract.
- B. Prepare a complete file of maintenance and operating instructions which covers all electrical systems and equipment listed in the section entitled "Submittals".
- C. Data shall be placed in an 8-1/2" x 11" slide hinge, heavy duty, three-post type, stiff cover binder. Each completed binder shall not exceed 3-1/2" in thickness. Label binder as follows:

ELECTRICAL SYSTEMS  
MAINTANENANCE AND OPERATING INSTRUCTIONS  
SATELLITE JAIL  
HVAC REPLACEMENT  
URBANA, ILLINOIS

- D. Data shall include a complete table of contents, tabs, final approved shop drawings, wiring diagrams, manufacturer's operating and maintenance instructions, catalog brochure information, replacement parts lists, name, address and telephone number of nearest stocking supply house.
- E. Drawings shall be neatly folded to approximately 8-1/2" x 11" size and inserted individually into 8-1/2" x 11" sheet protectors which shall be properly punched and inserted into the binder.
- F. All material relative to the equipment for one system (i.e.; lighting fixtures, panelboards, motor starting equipment, etc.) shall be filed behind a clearly labeled filing tab. The following information shall be typed on the filing tab page: Item, Manufacturer, Contractor's Order Number, Supplier's Order Number, Manufacturer's Order Number.
- G. Three completed files shall be submitted for review prior to job completion. Final payments will not be certified until the maintenance manuals have been received and reviewed.

- H. Authorized manufacturer's personnel shall instruct (to the Owner's satisfaction) all personnel designated by the Owner in the use of equipment and systems as listed in the section entitled "Submittals".
- I. Provide a minimum of two man days in two trips to the job before the job is accepted for the instruction and training of the Owner's representative in the operation and maintenance of the complete electrical system.
- J. The above does not relieve the contractor of his responsibility of making service calls due to any defect which may develop with systems or equipment during the guarantee period nor shall these service calls be included as part of instruction time. Specific requirements in specifications for factor service representatives is also in addition to above requirements.

### 3.12 CLEANING UP

- A. Before work can be considered complete, clean all surfaces of all paint, plaster, mortar, labels and other stains and remove all lumps of cement. Take care not to scratch, mar, or damaged surfaces in cleaning.
- B. In case of dispute, the Owner / User may remove the rubbish and charge the cost to the one or more contractors as the Architect / Engineer may determine to be just.

END OF SECTION 26 0500

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Building wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. General Cable; General Cable Corporation.
  - 2. Senator Wire & Cable Company.
  - 3. Southwire Company.
  - 4. Nexans.
- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. 3M.
  - 2. Hubbell Power Systems, Inc.
  - 3. ILSCO.
  - 4. Tyco Electronics Corp.

- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
  - 1. Expandable steel spring and polypropylene body type connectors and wire nuts for wire sizes up to an including No. 10 AWG.
  - 2. Bolt type connectors or mechanical compression crimp type for wire sizes No. 8 AWG and larger. Cover connectors with three layers of 600 volt tape or heat shrinkable insulation equivalent to 150% conductor insulation.

### 2.3 SYSTEM DESCRIPTION

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

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- C. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
- E. Minimum wire size shall be No. 12 except for internal fixture wire which shall be minimum size of No. 14 type SF, SFF, PF, PFF or TFN, 600 volt.
- F. All branch circuit wiring and feeder cables for circuits over 20 amps shall be sized as noted on the drawings. If size is not specifically noted, size all branch circuit wiring and feeder cables in accordance with the National Electrical Code.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Splices and taps in conductors shall be as few in number as practicable.
- D. Splices and taps shall be so made that they have an electrical resistance not in excess of that of 2' of the conductor.
  - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- E. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.
- F. Neutral conductors in outlet boxes at receptacles shall be jointed and pigtailed to the outlet. The removal of a receptacle from the circuit shall not affect the continuity of the neutral conductor.



### 3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

### 3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

### 3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
  - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

END OF SECTION 26 0519

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment.
- B. Section includes grounding and bonding systems and equipment, plus the following special applications:
  - 1. Underground distribution grounding.
  - 2. Foundation steel electrodes.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Burndy; Part of Hubbell Electrical Systems.
  - 2. Dossert; AFL Telecommunications LLC.
  - 3. ERICO International Corporation.
  - 4. Fushi Copperweld Inc.
  - 5. Galvan Industries, Inc.; Electrical Products Division, LLC.
  - 6. Harger Lightning & Grounding.
  - 7. ILSCO.
  - 8. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - 9. Robbins Lightning, Inc.
  - 10. Siemens Power Transmission & Distribution, Inc.

## 2.2 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

## 2.3 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

## 2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

### 3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits. Separate grounding conductors are not shown on the drawings but shall be included in all raceways as set forth on the drawings.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70. Separate grounding conductors are not shown on the drawings but shall be included in all raceways as set forth on the drawings.
  - 1. Feeders and branch circuits.
  - 2. Receptacle circuits.
  - 3. Single-phase motor and appliance branch circuits.
  - 4. Three-phase motor and appliance branch circuits.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

### 3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

END OF SECTION 26 0526

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
    - a. Hangers.
    - b. Steel slotted support systems.
  - 2. Include rated capacities and furnished specialties and accessories.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
  - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
    - a. **Cooper B-Line, Inc.; a division of Cooper Industries.**
    - b. **Flex-Strut Inc.**
    - c. **Unistrut; an Atkore International company.**
  - 2. Material: Galvanized steel.

3. Channel Width: 1-5/8 inches.
  4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  5. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
  6. Channel Dimensions: Selected for applicable load criteria.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

### PART 3 - EXECUTION

#### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.
- B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  1. Secure raceways and cables to these supports with two-bolt conduit clamps.

#### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners. Anchors using explosive charges to drive inserts into concrete shall not be used.
  - 5. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69 or metal framing channel welded to structure.
  - 6. To Light Steel: Sheet metal screws.
  - 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.
- E. Repair fireproofing damaged as a result of installing clamps or supports to structural steel.

### 3.3 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.
- C. Prime paint all structural steel installed for pipe or equipment supports or burned by welding with one coat of rust inhibitive black paint at the time of installation.

END OF SECTION 26 0529

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Metal conduits, tubing, and fittings.
  - 2. Surface raceways.
  - 3. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Allied Tube & Conduit; a part of Atkore International.
  - 2. Republic Conduit.
  - 3. Western Tube and Conduit Corporation.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.



- D. EMT: Comply with ANSI C80.3 and UL 797.
- E. FMC: Comply with UL 1; zinc-coated steel.
- F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
  - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
  - 2. Fittings for EMT:
    - a. Material: Steel.
    - b. Type: Compression.
  - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

## 2.2 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Technologies Company.
  - 2. Hubbell Incorporated.
  - 3. MonoSystems, Inc.
  - 4. RACO; Hubbell.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- F. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- G. Gangable boxes are prohibited.

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
3. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: EMT. Raceway locations include the following:
  - a. Loading dock.
  - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
  - c. Mechanical rooms.
  - d. Gymnasiums.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Damp or Wet Locations: GRC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
  - a. All boxes installed in poured concrete, block, brick or tile shall be masonry type.
  - b. All multiple gang switch boxes shall be solid gang box.
  - c. All surface-mounted boxes shall be cast FS or FD type.
  - d. The minimum size of boxes shall be 4" x 4" x 2-1/8" minimum depth. For single device installation, install square cut single device cover.
  - e. Install all device boxes with square cut device covers for number of devices required.
  - f. For multiple gang boxes installed for more than one 277 volt switch, a barrier shall be installed between each box gang.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.

### 3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Conduits and raceways shall not be supported from plumbing lines, ductwork or supports for equipment provided by other trades.
- F. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- G. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- J. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- K. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- L. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- M. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
  - 1. Use LFMC in damp or wet locations subject to severe physical damage.
  - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- N. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- O. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

### 3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

### 3.4 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

### 3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.
- B. Protect work from injury by keeping all conduit and boxes capped and plugged or otherwise protected. This includes damage by freezing and / or stoppage from building materials, sand, dirt or concrete.

END OF SECTION 26 0533

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
  - 2. Sleeve-seal systems.
  - 3. Grout.
  - 4. Silicone sealants.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Wall Sleeves:
  - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.2 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## 2.3 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
  - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
  - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
    - a. Seal annular space between sleeve and raceway or cable, using silicone sealant appropriate for size, depth, and location of joint.
    - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
  - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
  - 4. Install sleeves for all wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
  - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
  - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
  
- E. Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve-seal system.

END OF SECTION 26 0544

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Identification for raceways.
  - 2. Equipment identification labels, including arc-flash warning labels.
  - 3. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

2.2 SIGNS

- A. Laminated Acrylic or Melamine Plastic Signs:
  - 1. Engraved legend.
  - 2. Thickness:
    - a. For signs up to 20 sq. inches, minimum 1/16-inch-.



- b. For signs larger than 20 sq. inches, 1/8 inch thick.
  - c. Engraved legend with black letters on white face.
  - d. Punched or drilled for mechanical fasteners.
  - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Brady Corporation.
  - b. Carlton Industries, LP.
  - c. emedco.

### 2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

### 3.2 IDENTIFICATION SCHEDULE

- A. Power-Circuit Conductor Identification, 600 V or Less:
  - 1. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

- a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
  - b. Colors for 208/120-V Circuits:
    - 1) Phase A: Black.
    - 2) Phase B: Red.
    - 3) Phase C: Blue.
    - 4) Neutral: White.
    - 5) Ground: Green.
  - c. Colors for 480/277-V Circuits:
    - 1) Phase A: Brown.
    - 2) Phase B: Orange.
    - 3) Phase C: Yellow.
    - 4) Neutral: White.
    - 5) Ground: Green with yellow stripe.
  - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- B. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.
- 1. Labeling Instructions:
    - a. Indoor Equipment: Engraved, laminated acrylic or melamine plastic label, punched or drilled for mechanical fasteners. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    - d. Fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
    - e. Attach labels with screws and not adhesives.
  - 2. Equipment To Be Labeled:
    - a. Access doors and panels for concealed electrical items.
    - b. Switchgear.
    - c. Motor-control centers.

- d. Enclosed switches.
- e. Enclosed circuit breakers.
- f. Enclosed controllers.
- g. Variable-speed controllers.
- h. Push-button stations.

END OF SECTION 26 0553

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. GFCI receptacles.

1.3 DEFINITIONS

- A. Abbreviations of Manufacturers' Names:
  - 1. Cooper: Cooper Wiring Devices; Division of Cooper Industries, Inc.
  - 2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
  - 3. Leviton: Leviton Mfg. Company, Inc.
  - 4. Pass & Seymour: Pass& Seymour/Legrand.
- B. BAS: Building automation system.
- C. EMI: Electromagnetic interference.
- D. GFCI: Ground-fault circuit interrupter.
- E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- F. RFI: Radio-frequency interference.
- G. SPD: Surge protective device.
- H. UTP: Unshielded twisted pair.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

## PART 2 - PRODUCTS

### 2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices for Owner-Furnished Equipment:
  - 1. Receptacles: Match plug configurations.
  - 2. Cord and Plug Sets: Match equipment requirements.
- D. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

### 2.2 GFCI RECEPTACLES

- A. General Description:
  - 1. 125 V, 20 A, straight blade, feed-through type.
  - 2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
  - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Duplex GFCI Convenience Receptacles:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton (Arrow Hart).
    - b. Hubbell Incorporated; Wiring Device-Kellems.
    - c. Leviton Manufacturing Co., Inc.
    - d. Pass & Seymour/Legrand (Pass & Seymour).

### 2.3 FINISHES

- A. Device Color:

1. Wiring Devices Connected to Normal Power System: White unless otherwise indicated or required by NFPA 70 or device listing.
- B. The Architect / Engineer reserves the right to change the color at time of shop drawing review.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Mounting Heights
1. Examine architectural details and elevations for heights indicated there. Coordinate mounting heights with wall treatment and finish.
  2. Examine electrical drawings for heights indicated there.
  3. Unless otherwise indicated:
    - a. Wall Switches: 48" above finished floor, except where special wall treatment requires a higher or lower setting.
    - b. Dimmer and Lighting Controls: 48" AFF, except where special wall treatment requires higher or lower setting.
    - c. Receptacles - General: 18" AFF.
    - d. Receptacles in Mechanical and Electrical Equipment Rooms: 40" AFF.
    - e. Receptacles - Exterior: 24" above finished grade.
  4. Mounting heights given above shall be to the center line of the device.
  5. In block walls, locate device in either bottom or top of the block course nearest to the height indicated.
  6. In brick walls, mount receptacles in the horizontal position in the brick course nearest to the height indicated.
  7. Where receptacles are indicated to be installed above counters, mount in the horizontal position 4" from top of back splash to bottom of box.
- C. Coordination with Other Trades:
1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
  2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  4. Install wiring devices after all wall preparation, including painting, is complete.

D. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
  - a. Cut back and pigtail, or replace all damaged conductors.
  - b. Straighten conductors that remain and remove corrosion and foreign matter.
  - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

E. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

F. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.

G. Device Plates: Device plates shall fit tight against the finished walls and shall completely cover the openings in the walls for the boxes. Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening. Device plates shall be attached and adjusted so they finish straight and level.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

### 3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

### 3.3 GROUND FAULT INTERRUPTING RECEPTACLES

- A. Where drawing or specifications call for 15 amp or 20 amp, 120 volt receptacles in the following locations, provide ground fault interrupting type receptacles.

- 1. Outdoors.

### 3.4 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."

- 1. Receptacles and Switches: Provide all outlet and switch coverplates with identification labels showing panelboard designation and circuit breaker number connected to device.
  - a. Normal Circuits: Black letters indicating panel and circuit number on clear background applied to front of coverplate. Minimum letter height 3/16".
  - b. Emergency Circuits: Red letter indicating panel and circuit number on clear background applied to front of coverplate. Minimum letter height 3/16".
- 2. Labels shall be attached to coverplates with pressure-sensitive adhesive. Devices installed in multi-outlet, surface raceways shall be provided with labels.

END OF SECTION 26 2726



PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Cartridge fuses rated 600 V ac and less for use in the following:
    - a. Control circuits.
    - b. Motor-control centers.
    - c. Panelboards.
    - d. Switchboards.
    - e. Enclosed controllers.
    - f. Enclosed switches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
  - 1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
    - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
    - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
  - 2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
  - 3. Current-limitation curves for fuses with current-limiting characteristics.
  - 4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit in PDF format.
  - 5. Coordination charts and tables and related data.
  - 6. Fuse sizes for elevator feeders and elevator disconnect switches.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.
  - 1. Ambient temperature adjustment information.
  - 2. Current-limitation curves for fuses with current-limiting characteristics.
  - 3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse used on the Project. Submit in PDF format.
  - 4. Coordination charts and tables and related data.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

#### 1.6 FIELD CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
  - 1. **Bussmann, an Eaton business.**
  - 2. **Edison; a brand of Bussmann by Eaton.**
  - 3. **Littelfuse, Inc.**
  - 4. **Mersen USA.**
- B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

#### 2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

1. Type RK-1: 250 or 600-V, zero- to 600-A rating, 200 kAIC, time delay.
  2. Type L: 600-V, 601- to 6000-A rating, 200 kAIC, time delay.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 FUSE APPLICATIONS

- A. Cartridge Fuses:
1. Feeders, 601 Amp through 6000 Amp: Class L, time delay.
  2. Feeders, up to 600 Amp: Class RK1, time delay.
  3. Motor Branch Circuits: Class RK1, time delay.
  4. Other Branch Circuits: Class RK1, time delay.
  5. Provide open-fuse indicator fuses or fuse covers with open fuse indication.

#### 3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

### 3.4 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 26 2813

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Molded-case circuit breakers (MCCBs).
  - 4. Molded-case switches.
  - 5. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 4. Include evidence of a nationally recognized testing laboratory (NRTL) listing for series rating of installed devices.
  - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF electronic format.

B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include wiring diagrams for power, signal, and control wiring.

## 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  - a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

## 1.6 FIELD CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

## 1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Source Limitations:

1. Obtain fusible switches, non-fusible switches, molded case circuit breakers and switches from the same manufacturer as:
  - a. Enclosed controllers.
  - b. Switchboards.
  - c. Distribution panelboards.
  - d. Branch circuit panelboards.
  - e. Motor control centers.
  - f. Enclosed busway.
  - g. Low voltage transformers.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- E. Comply with NFPA 70.

## 2.2 FUSIBLE SWITCHES

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
  1. **Eaton.**
  2. **General Electric Company.**
  3. **Siemens Industry, Inc.**
  4. **Square D; by Schneider Electric.**
- B. Type HD, Heavy Duty:
  1. Single throw.
  2. Three pole.
  3. 240 or 600-V ac as specified on drawings.
  4. 1200 A and smaller.
  5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
  6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
  1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 24-V ac.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.

### 2.3 NONFUSIBLE SWITCHES

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
  1. Eaton.
  2. General Electric Company.
  3. Siemens Industry, Inc.
  4. Square D; by Schneider Electric.
- B. Type HD, Heavy Duty, Three Pole, Single Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
  1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  3. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 24-V ac.
  4. Lugs: Mechanical type, suitable for number, size, and conductor material.

### 2.4 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1) gray baked enamel paint, electrodeposited on cleaned, phosphatized galvanized steel (NEMA 250 Types 3R, 12).
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.
- D. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.



## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

### 3.2 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
  - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
  - 2. Outdoor Locations: NEMA 250, Type 3R.

### 3.3 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install fuses in fusible devices.
- F. Comply with NFPA 70 and NECA 1.

### 3.4 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### 3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections for Switches:
  1. Visual and Mechanical Inspection:
    - a. Inspect physical and mechanical condition.
    - b. Inspect anchorage, alignment, grounding, and clearances.
    - c. Verify that the unit is clean.
    - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
    - e. Verify that fuse sizes and types match the Specifications and Drawings.
    - f. Verify that each fuse has adequate mechanical support and contact integrity.
    - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
      - 1) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
        - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
    - h. Verify correct phase barrier installation.
    - i. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
- C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

### 3.6 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 26 2816

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Manual motor controllers.
  - 2. Combination full-voltage magnetic motor controllers.
  - 3. Enclosures.
  - 4. Accessories.
  - 5. Identification.

1.3 DEFINITIONS

- A. CPT: Control power transformer.
- B. MCCB: Molded-case circuit breaker.
- C. MCP: Motor circuit protector.
- D. NC: Normally closed.
- E. OCPD: Overcurrent protective device.
- F. SCCR: Short-circuit current rating.
- G. SCPD: Short-circuit protective device.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For each type of magnetic controller.

1. Include plans, elevations, sections, and mounting details.
2. Indicate dimensions, weights, required clearances, and location and size of each field connection.
3. Wire Termination Diagrams and Schedules: Include diagrams for signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.
4. Include features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

C. Product Schedule: List the following for each enclosed controller:

1. Each installed magnetic controller type.
2. NRTL listing.
3. Factory-installed accessories.
4. Nameplate legends.
5. SCCR of integrated unit.
6. For each combination magnetic controller include features, characteristics, ratings, and factory setting of the SCPD and OCPD.
  - a. Listing document proving Type 2 coordination.
7. For each series-rated combination state the listed integrated short-circuit current (withstand) rating of SCPD and OCPDs by an NRTL acceptable to authorities having jurisdiction.

## 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For magnetic controllers to include in operation and maintenance manuals.

1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:
  - a. Routine maintenance requirements for magnetic controllers and installed components.
  - b. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
  - c. Manufacturer's written instructions for setting field-adjustable overload relays.
  - d. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
  - e. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

## 1.6 QUALITY ASSURANCE

### A. Source Limitations:

1. Obtain enclosed controllers from the same manufacturer as:
  - a. Fusible and non-fusible switches.
  - b. Molded case circuit breakers.
  - c. Switchboards.
  - d. Distribution panelboards.
  - e. Branch circuit panelboards.
  - f. Motor control centers.
  - g. Enclosed busway.
  - h. Low voltage transformers.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

## 1.8 FIELD CONDITIONS

- A. Ambient Environment Ratings: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  1. Ambient Temperature: Not less than 23 deg F and not exceeding 104 deg F.
  2. Altitude: Not exceeding 6600 feet for electromagnetic and manual devices.
  3. The effect of solar radiation is not significant.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. UL Compliance: Fabricate and label magnetic motor controllers to comply with UL 508 and UL 60947-4-1.
- C. NEMA Compliance: Fabricate motor controllers to comply with ICS 2.

## 2.2 MANUAL MOTOR CONTROLLERS

- A. Motor-Starting Switches (MSS): "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton.
    - b. General Electric Company.
    - c. Siemens Industry, Inc.
    - d. Square D; by Schneider Electric.
  - 2. Standard: Comply with NEMA ICS 2, general purpose, Class A.
  - 3. Configuration: Nonreversing.
  - 4. Surface mounting.
  - 5. Red pilot light.
- B. Fractional Horsepower Manual Controllers (FHPMC): "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton.
    - b. General Electric Company.
    - c. Siemens Industry, Inc.
    - d. Square D; by Schneider Electric.
  - 2. Configuration: Nonreversing.
  - 3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; melting alloy type.
  - 4. Pilot Light: Red.

## 2.3 ENCLOSURES

- A. Comply with NEMA 250, type designations as indicated on Drawings, complying with environmental conditions at installed location.
  - 1. Dry and Clean Indoor Locations: Type 1.
  - 2. Outdoor Locations: Type 3R.
- B. The construction of the enclosures shall comply with NEMA ICS 6.
- C. Controllers in hazardous (classified) locations shall comply with UL 1203 and shall be NEMA 250, Type 7C.

## 2.4 ACCESSORIES

- A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
  - 1. Push Buttons, Pilot Lights, and Selector Switches: Standard-duty, except as needed to match enclosure type. Heavy-duty or oil-tight where indicated in the controller schedule.
    - a. Push Buttons: As indicated in the controller schedule.
    - b. Pilot Lights: As indicated in the controller schedule.

## 2.5 IDENTIFICATION

- A. Controller Nameplates: Laminated acrylic plastic signs, as described in Section 26 0553 "Identification for Electrical Systems," for each compartment, mounted with corrosion-resistant screws.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and space conditions for compliance with requirements for motor controllers, their relationship with the motors, and other conditions affecting performance of the Work.

### 3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Wall-Mounted Controllers: Install magnetic controllers on walls with tops at uniform height indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 26 0529 "Hangers and Supports for Electrical Systems" unless otherwise indicated.
- C. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.
- D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- E. Setting of Overload Relays: Select and set overloads on the basis of full-load current rating as shown on motor nameplate. Adjust setting value for special motors as required by NFPA 70 for motors that are high-torque, high-efficiency, and so on.

### 3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

### 3.4 APPLICATIONS

- A. Provide separately mounted motor controllers as scheduled and shown on the drawings.
- B. Provide separate hand-off auto selector switch with maintained contacts in separate enclosure adjacent to manual starters where shown on the drawings or noted in the starter schedule.
- C. Provide combination magnetic starters for all multiple phase operated equipment, as indicated in the starter schedule. All starters shall be complete with pilot lights in cover, externally operated fused disconnect switch, fuses, and three (3) proper sized overload heaters as required. Furnish additional accessories, such as auxiliary contacts, on-off selector switches, hand-off auto selector switches and push button with the starter as indicated in the schedule. All push-button and hand-off auto selector switches shall have maintained contacts.
- D. Provide all magnetic and manual starters with properly sized overload elements.
- E. Furnish controllers with additional accessories, such as auxiliary contacts, on-off push buttons and hand-off auto selector switches with the starter as indicated in the schedule.
- F. All magnetic starters shall be provided with control coils for 120 volt control voltage. All 208 volt starters shall have a neutral in the circuit and control voltage shall be phase to neutral 120 volts. Control transformers shall be furnished for 480 volt starters. Provide in-line fuse in secondary circuit of control transformer.
- G. The schedule of starters as shown on the drawings shall indicate motor horse power, phase, voltage, starter size, starter type, auxiliary contacts, types of accessories; such as push buttons or hand-off-automatic switches.

### 3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Comply with the provisions of NFPA 70B, "Testing and Test Methods" Chapter.
  - 2. Visual and Mechanical Inspection:
    - a. Compare equipment nameplate data with drawings and specifications.
    - b. Inspect physical and mechanical condition.
    - c. Inspect anchorage, alignment, and grounding.
    - d. Verify the unit is clean.
    - e. Inspect contactors:



- 1) Verify mechanical operation.
  - 2) Verify contact gap, wipe, alignment, and pressure are according to manufacturer's published data.
- f. Motor-Running Protection:
- 1) Verify overload element rating is correct for its application.
  - 2) If motor-running protection is provided by fuses, verify correct fuse rating.
- g. Inspect bolted electrical connections for high resistance using one of the two following methods:
- 1) Use a low-resistance ohmmeter. Compare bolted connection resistance values with values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
  - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
- h. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
3. Infrared Inspection: Perform the survey during periods of maximum possible loading. Remove all necessary covers prior to the inspection.
- a. Comply with the recommendations of NFPA 70B, "Testing and Test Methods" Chapter, "Infrared Inspection" Article.
  - b. After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared inspection of the electrical power connections of each motor controller.
  - c. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each motor controller 11 months after date of Substantial Completion.
  - d. Report of Infrared Inspection: Prepare a certified report that identifies the testing technician and equipment used, and lists the following results:
    - 1) Description of equipment to be tested.
    - 2) Discrepancies.
    - 3) Temperature difference between the area of concern and the reference area.
    - 4) Probable cause of temperature difference.
    - 5) Areas inspected. Identify inaccessible and unobservable areas and equipment.
    - 6) Load conditions at time of inspection.
    - 7) Photographs and thermograms of the deficient area.
    - 8) Recommended action.

- e. Equipment: Inspect distribution systems with imaging equipment capable of detecting a minimum temperature difference of 1°C at 30°C. The equipment shall detect emitted radiation and convert detected radiation to a visual signal.
- f. Act on inspection results and recommended action, and considering the recommendations of NETA ATS, Table 100.18. Correct possible and probable deficiencies as soon as Owner's operations permit. Retest until deficiencies are corrected.

C. Motor controller will be considered defective if it does not pass tests and inspections.

END OF SECTION 26 2913.03

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and Bidding and Contract Provisions, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Metal conduits and fittings.
  - 2. Surface raceways.
  - 3. Boxes, enclosures, and cabinets.
- B. Coordinate pathway installation with Temperature Control Subcontractor.

1.3 ACTION SUBMITTALS

- A. Product Data: For surface pathways, wireways and fittings.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

- A. General Requirements for Metal Conduits and Fittings:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. EMT: Comply with ANSI C80.3 and UL 797.
- C. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

2.2 METAL WIREWAYS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

## 2.3 SURFACE PATHWAYS

- A. General Requirements for Surface Pathways:
  1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Pathways (Wiremold): Steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

## 2.4 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets.
- B. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- D. Device Box Dimensions: as required for the application.
- E. Cabinets shall be provided by the Control Subcontractor.

## PART 3 - EXECUTION

### 3.1 PATHWAY APPLICATION

- A. Indoors: Apply pathway products as specified below unless otherwise indicated:
  1. Exposed, in finished areas: Wiremold.
  2. Exposed, in unfinished areas (store rooms): EMT.
  3. Exposed and Subject to Severe Physical Damage: EMT. Pathway locations include the following:
    - a. Mechanical rooms.
  4. Concealed in Ceilings and Interior Walls and Partitions: Pathway not required.
  5. Horizontal Pathways for Communications Cable in Spaces Used for Environmental Air: Plenum-type, communications-cable in hog rings.
  6. Horizontal Pathways for Network Cable in Non-Plenum Ceiling Cavities: Cable with "hog rings".

- B. Minimum Pathway Size: 3/4-inch trade size.
- C. Pathway Fittings: Compatible with pathways and suitable for use and location.
  - 1. EMT: Use compression, steel fittings.

### 3.2 INSTALLATION

- A. Keep pathways at least 6 inches away from parallel runs of flues or hot-water pipes. Install horizontal pathway runs above water piping.
- B. Complete pathway installation before starting conductor installation.
- C. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for cables.
- D. Support conduit within 12 inches of enclosures to which attached.
- E. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- F. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- G. Cut conduit perpendicular to the length.
- H. Surface Pathways:
  - 1. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 36 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

### 3.3 EXISTING DDC CABLING

- A. Existing cabling may or may not be managed in terms of being neatly managed in ceiling cavities. This contract will not require that cabling to be cleaned up.
- B. All new cabling, however, must be neatly supported and managed. It is recommended that new cabling be a different color to avoid confusion between existing unmanaged cabling and new managed cabling.

END OF SECTION 27 0528

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and Bidding and Contract Provisions, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Network cabling to all DDC controls and controls and controllers and to building Ethernet.
  - 2. Cable connecting hardware, patch panels, and cross-connects.
  - 3. Cabling system identification products.
  - 4. Cable management system.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. LAN: Local area network.
- C. RCDD: Registered Communications Distribution Designer.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of cabling with Alpha Controls.

1.5 ACTION SUBMITTALS

- A. Shop Drawings:
  - 1. Cabling administration drawings and printouts.
  - 2. Wiring diagrams to show typical wiring schematics.

1.6 CLOSEOUT SUBMITTALS

- A. Software and Firmware Operational Documentation:

1. Device address list.
2. Printout of software application and graphic screens.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings and field testing program development by an RCDD employed by the Temperature Control Subcontractor.
  2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.

## PART 2 - PRODUCTS

### 2.1 CABLING

- A. Control Subcontractor shall consult with Owner's IT Administrator and ensure cable used will be compatible with Owner's network.
- B. Control Subcontractor shall consult with Owner's IT Administrator on method used to interface with Owner's network and facilitate remote access to control system.
- C. All cabling shall be plenum rated.

### 2.2 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.
1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
  2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
  3. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. The maximum allowable horizontal cable length will be determined by the Control Subcontractor.

## 2.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1 when tested according to test procedures of this standard.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 50 or less.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Grounding: Comply with J-STD-607-A.

## 2.4 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

## 2.5 CABLE MANAGEMENT SYSTEM

- A. Description: Computer-based cable management system, with integrated database and graphic capabilities.
- B. Document physical characteristics by recording the network, TIA/EIA details, and connections between equipment and cable.
- C. Information shall be presented in schematic plans.
  - 1. AutoCAD drawing software shall be used as drawing and schematic plans software.
- D. System shall interface with the following testing and recording devices:
  - 1. Direct upload tests from circuit testing instrument into the personal computer.
  - 2. Direct download circuit labeling into labeling printer.

## 2.6 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing service to evaluate cables.



## PART 3 - EXECUTION

### 3.1 WIRING METHODS

- A. Install cables in pathways except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal pathways and cables except in unfinished spaces.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
  - 2. Comply with requirements in Section 270528 "Pathways for Communications Systems."
- B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

### 3.2 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Comply with TIA/EIA-568-B.1.
  - 2. Terminate conductors; no cable shall contain unterminated elements.
  - 3. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
- C. Open-Cable Installation:
  - 1. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- D. Separation from EMI Sources:
  - 1. Comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
  - 2. Separation between open communications cables in raceways and unshielded power conductors and electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
  - 3. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.

4. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

### 3.3 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."

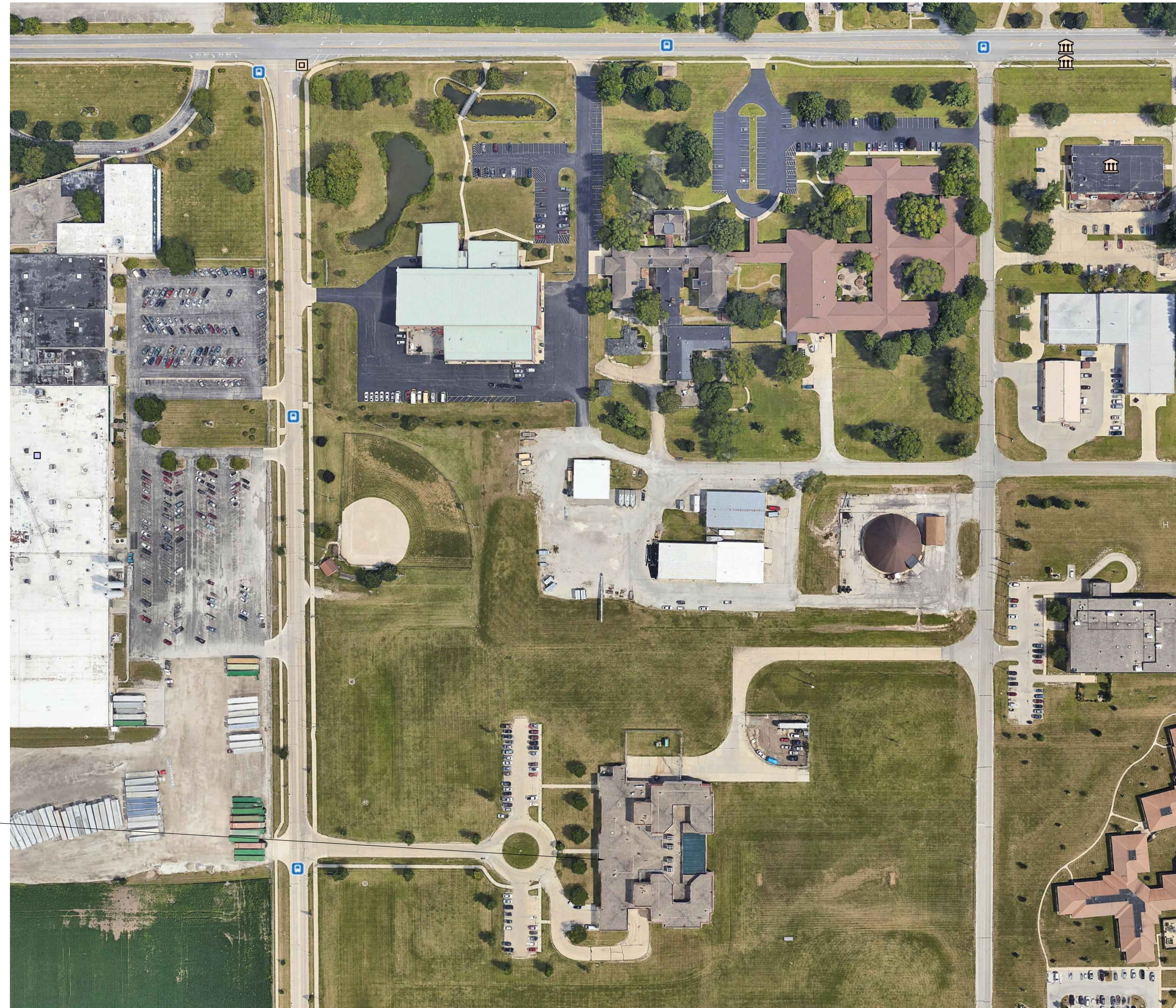
### 3.4 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

END OF SECTION 27 1500

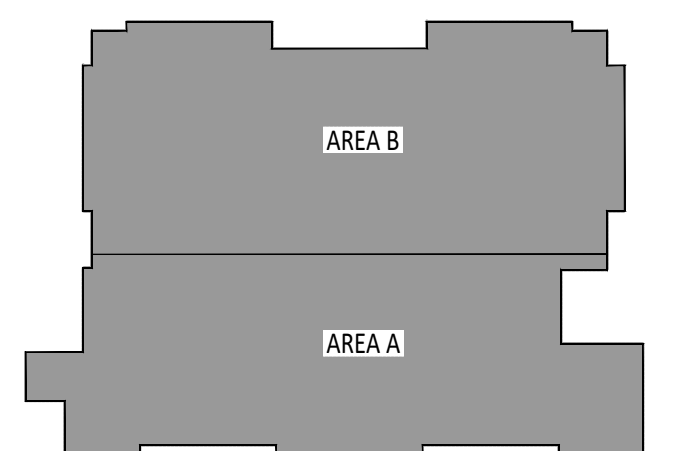


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SATELLITE JAIL


 SATELLITE IMAGE  
SCALE: NO SCALE



 KEY PLAN  
NO SCALE

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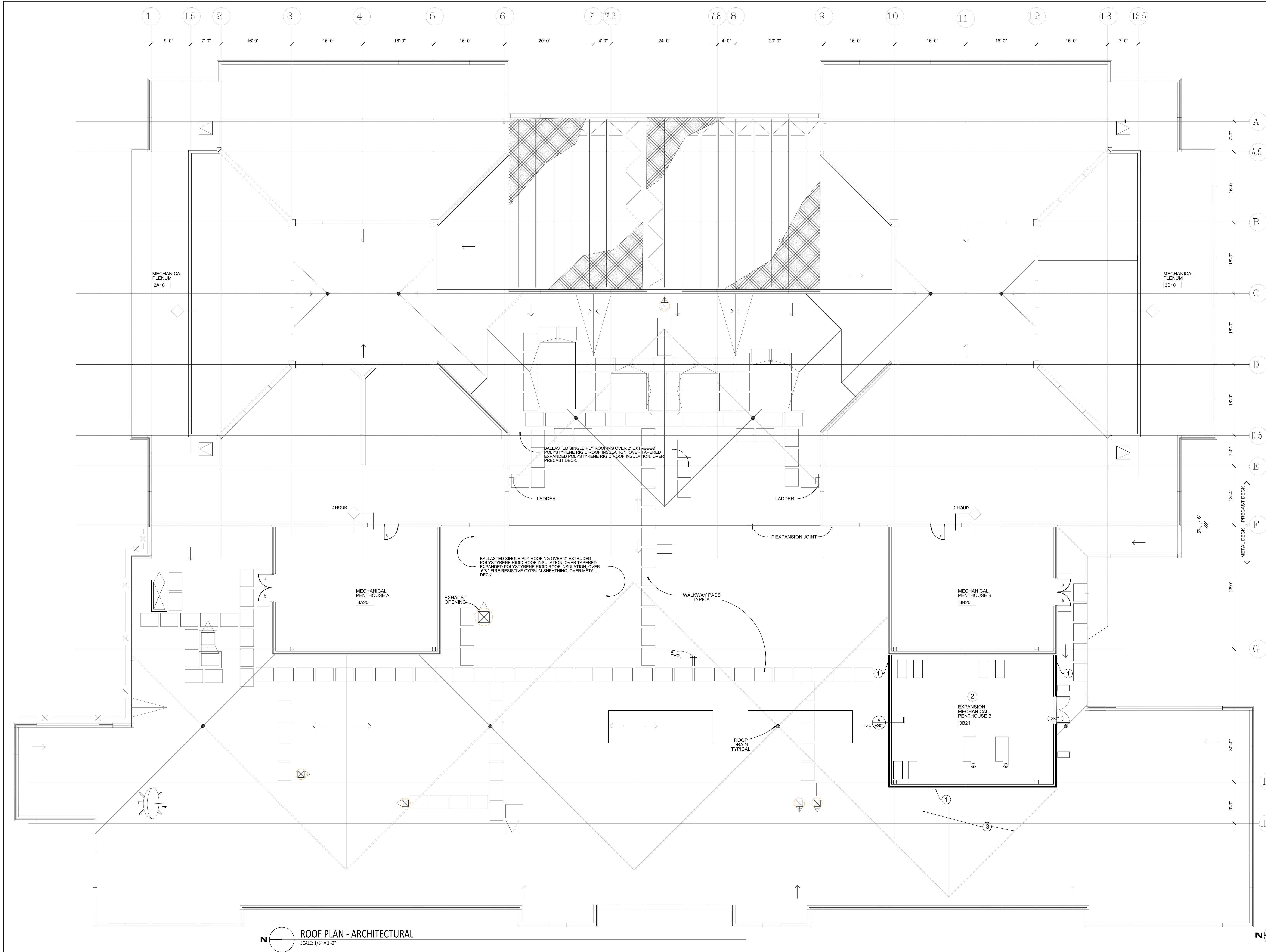
**COVER SHEET**  
**SATELLITE JAIL HVAC REPLACEMENT**  
CHAMPAIGN COUNTY  
502 S LIERMAN AVE URBANA, IL 61802

DATE:	APRIL 23, 2021	DESIGN:	JMD	APPROVED:	RCVN	SHEET:	<b>C-000</b>
PROJECT:	95% CD						
						GHR # 7253	



**KEYED PLAN NOTES**

- ① METAL WALL PANELS TO MATCH EXISTING
- ② CONCRETE SLAB ON EXISTING METAL DECK, SEAL CONCRETE
- ③ REVISE TAPERED INSULATION SADDLE AT NEW PENTHOUSE TO DIVERT WATER, REMOVE AND REPLACE MEMBRANE ROOFING AS REQUIRED



**ROOF PLAN - ARCHITECTURAL**  
SCALE: 1/8" = 1'-0"

**KEY PLAN**  
NO SCALE

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**ROOF PLAN - ARCHITECTURAL**  
**SATELLITE JAIL HVAC REPLACEMENT**  
CHAMPAIGN COUNTY  
502 S LIERMAN AVE URBANA, IL 61802

DATE:	APRIL 23, 2021
PROJECT:	IGW 2125-GHR # 7253

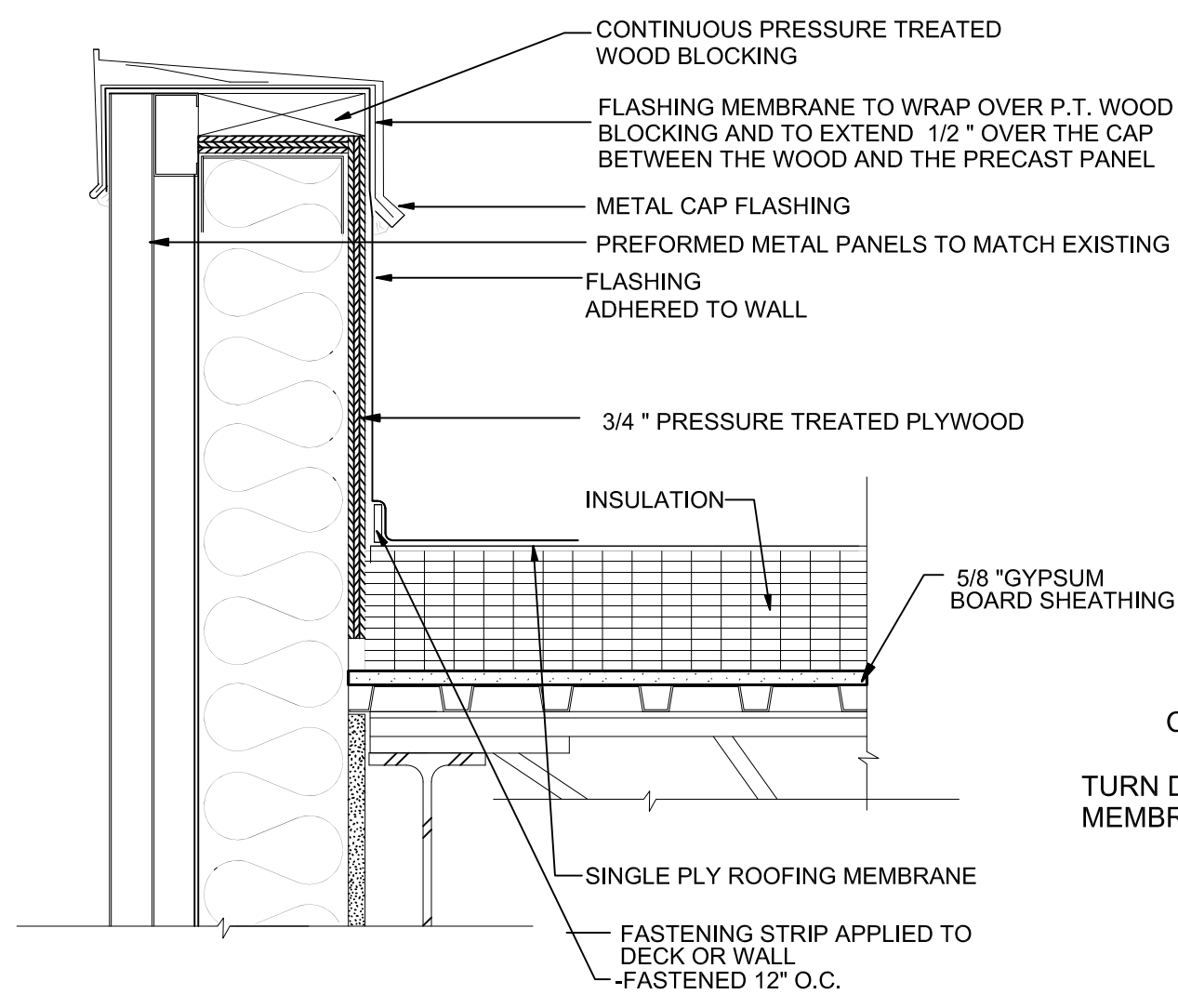
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628

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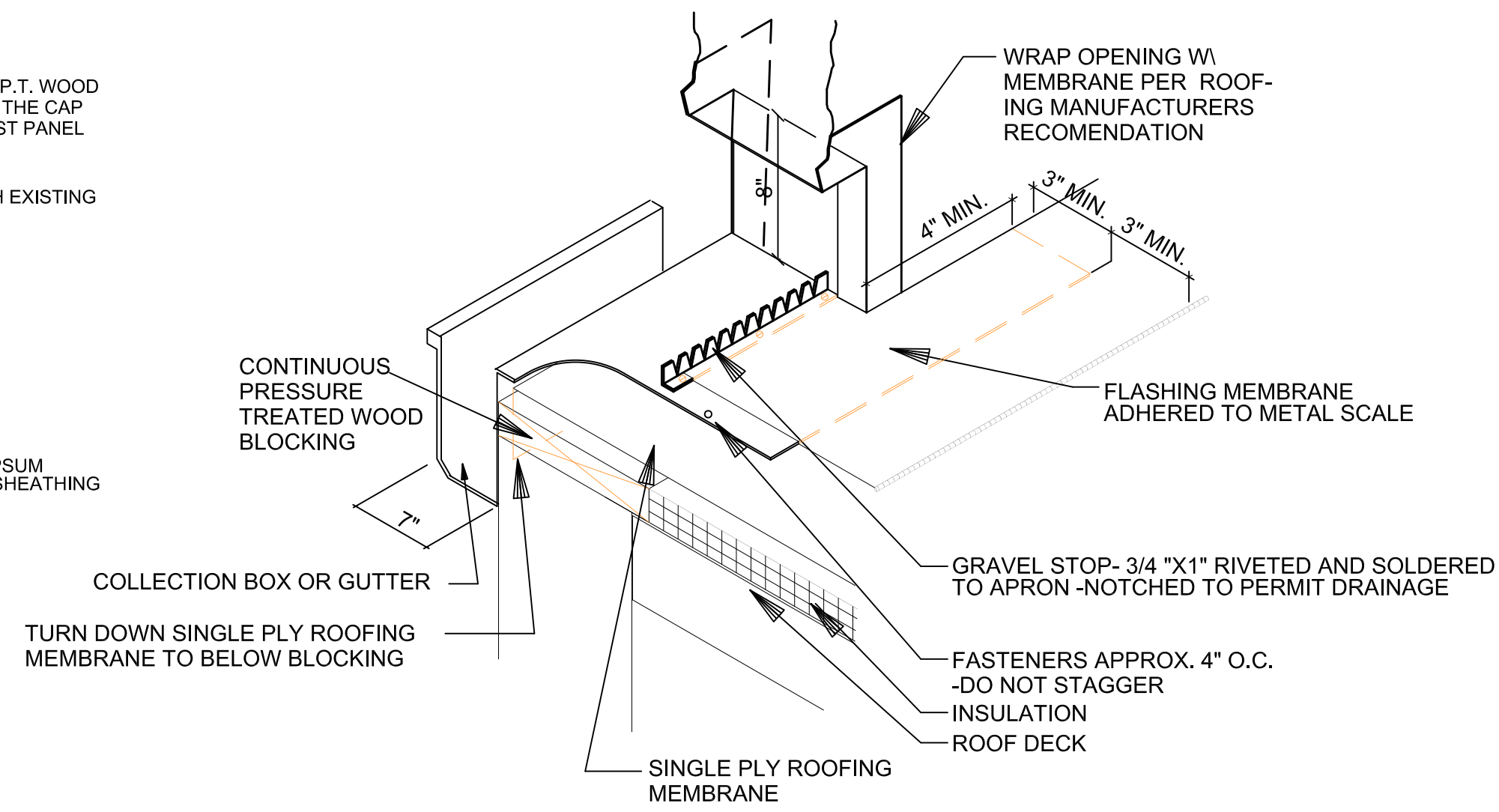


# DOOR/HARDWARE SCHEDULE

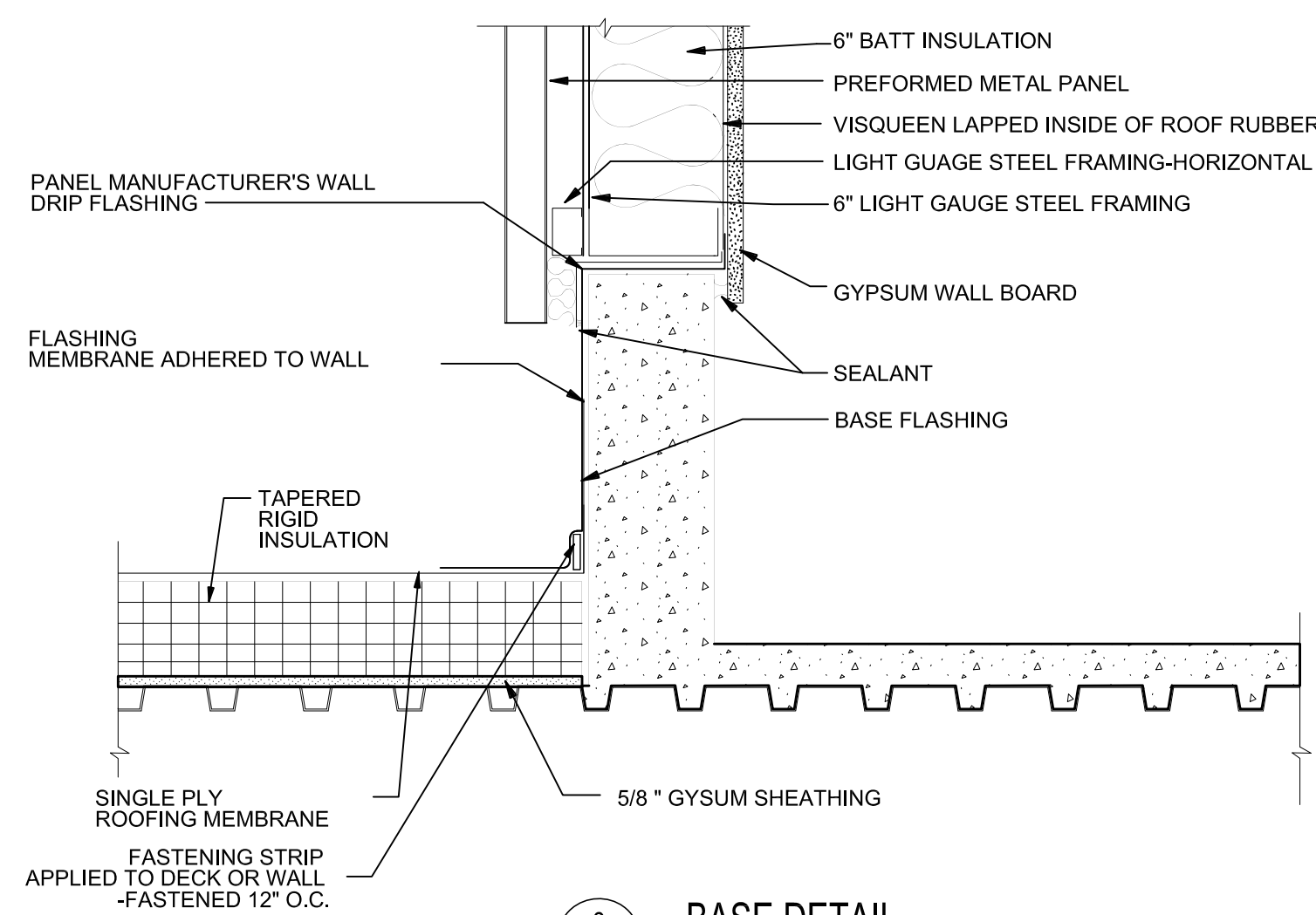
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DOOR NO.	ROOM NAME	QTY	SIZE			TYPE	MAT	FIN	TYPE	MAT	FIN	DEP	DETAILS			LABEL	BUTT	LOCK	BOLT		CLOSER	HOLD	PUSH	PULL	PLTS	STOP	T-HLD	SEAL	MISC
			W	H	T								HEAD	JAMB	SILL														
3B21	PENTHOUSE B1	2	3'-0"	7'-0"	1 3/4"	F	HM	PNT	F1	HM	PNT	5 3/4"	3/A201	-	3/A201	-	H1	L1	SB1	C1	H	-	-	-	-	-	T1	W1	-



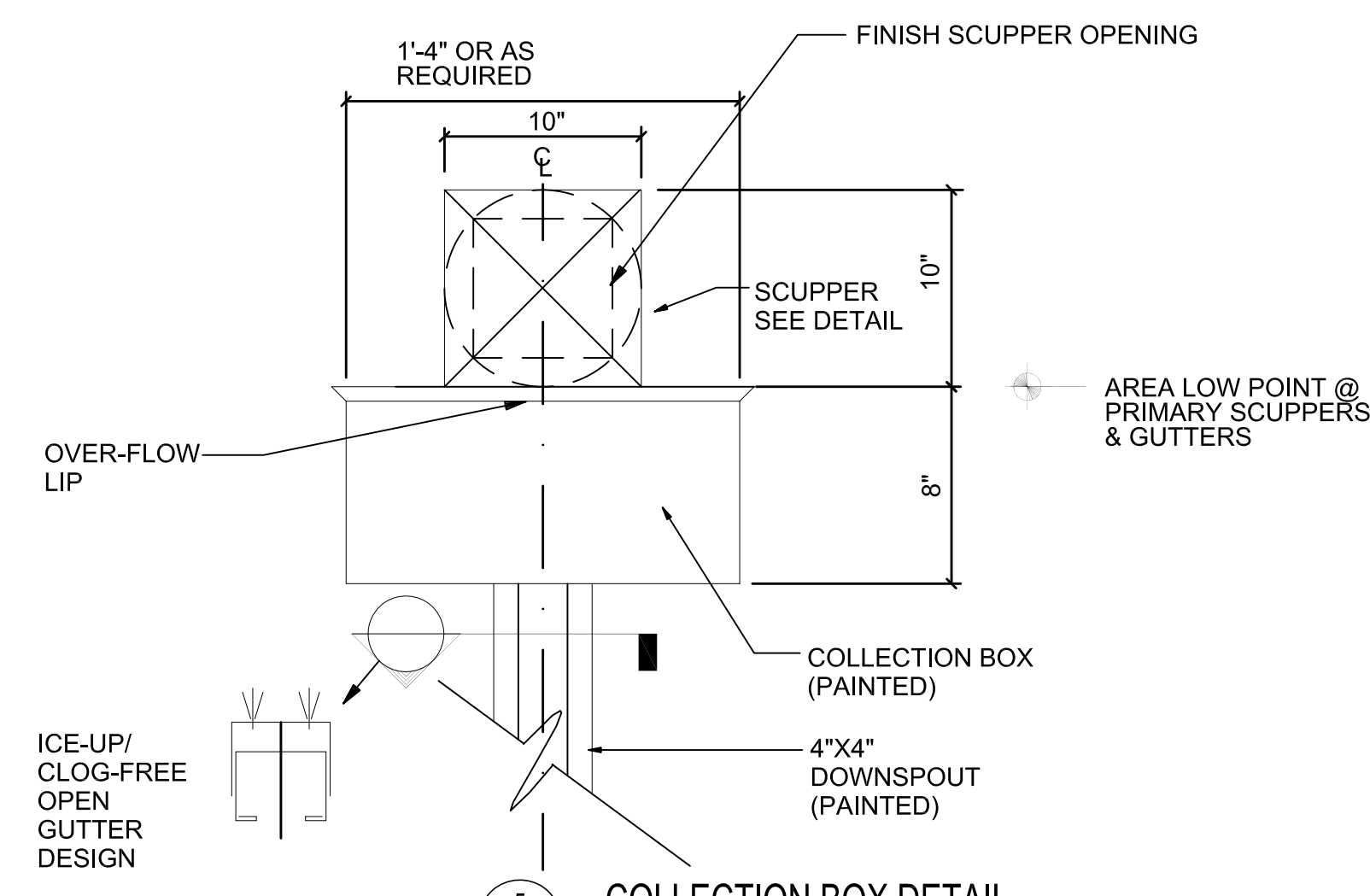
1 PARAPET DETAIL  
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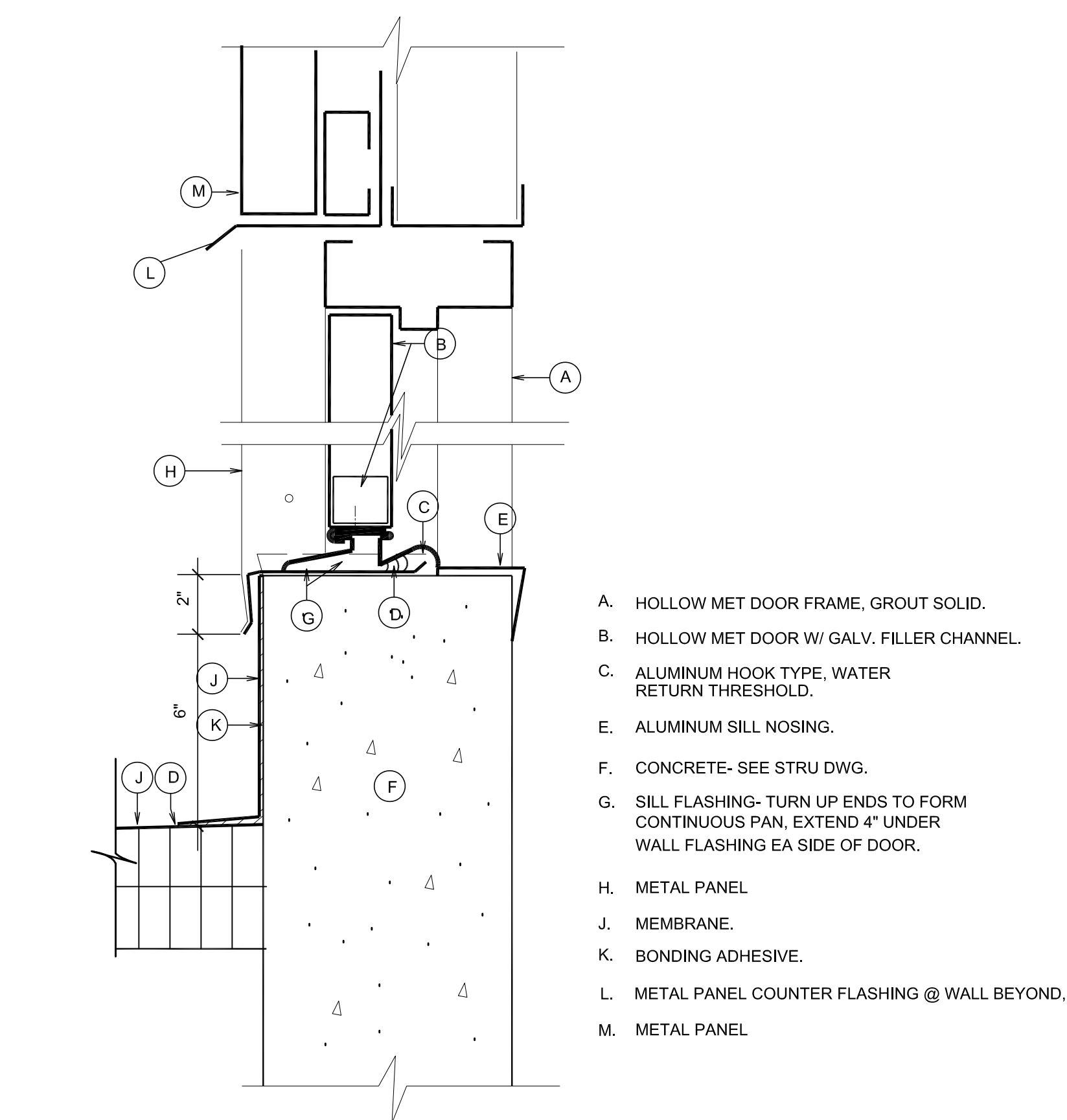
6 SCUPPER DETAIL  
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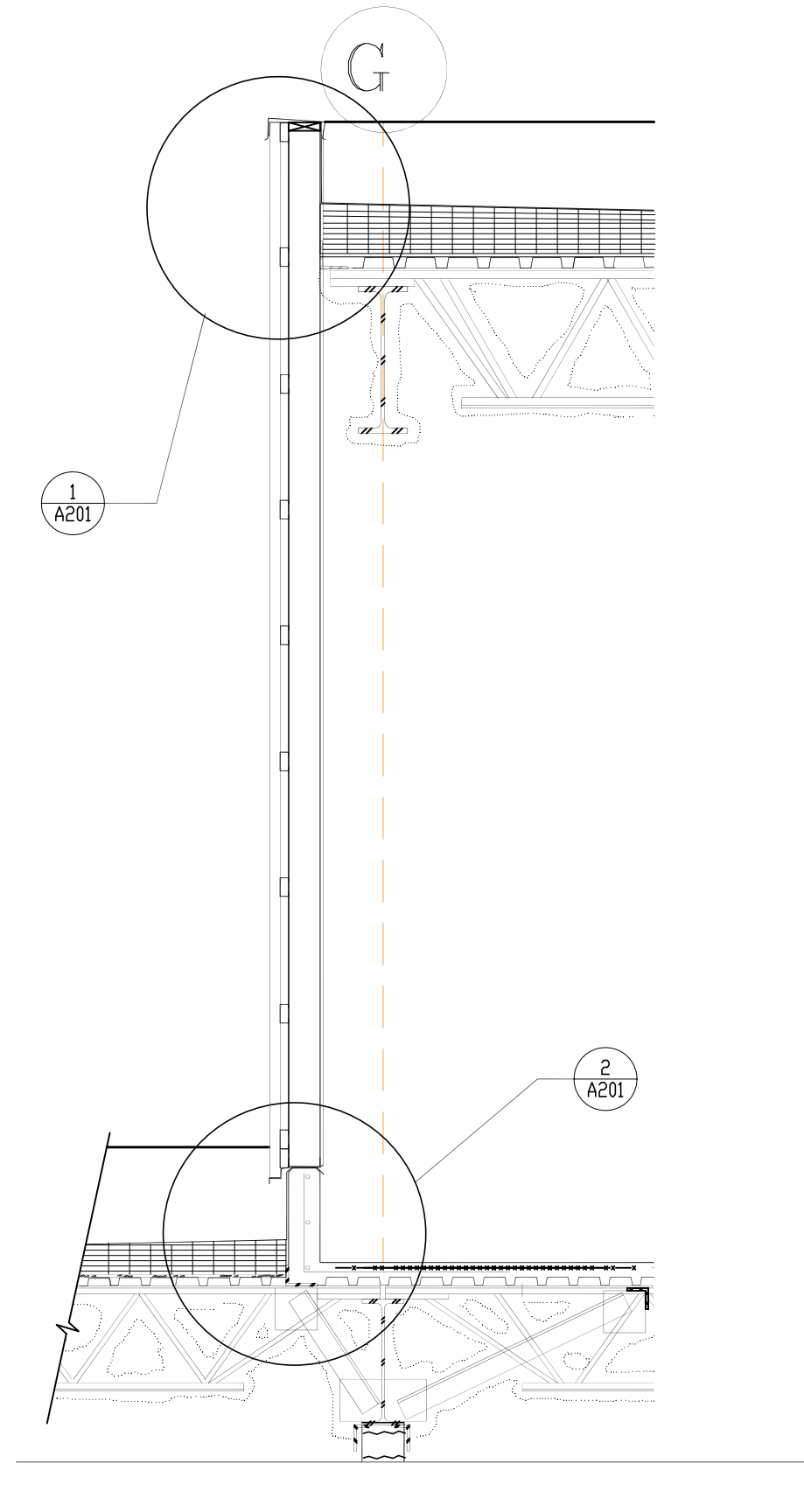
2 BASE DETAIL  
1 1/2" = 1'-0"



5 COLLECTION BOX DETAIL  
1 1/2" = 1'-0"



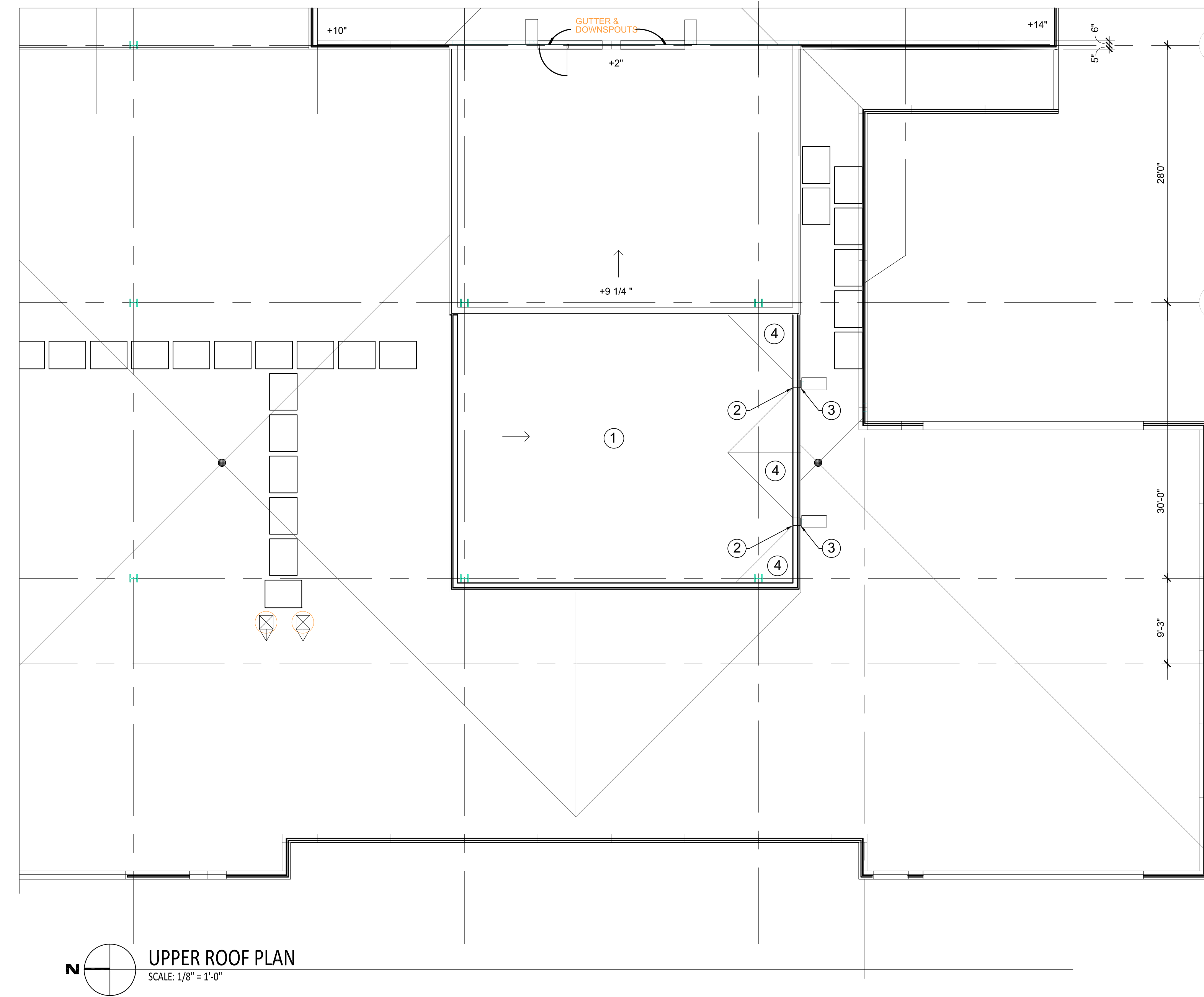
3 HEAD/SILL DETAIL  
3" = 1'-0"



4 PENTHOUSE SECTION  
1 1/2" = 1'-0"

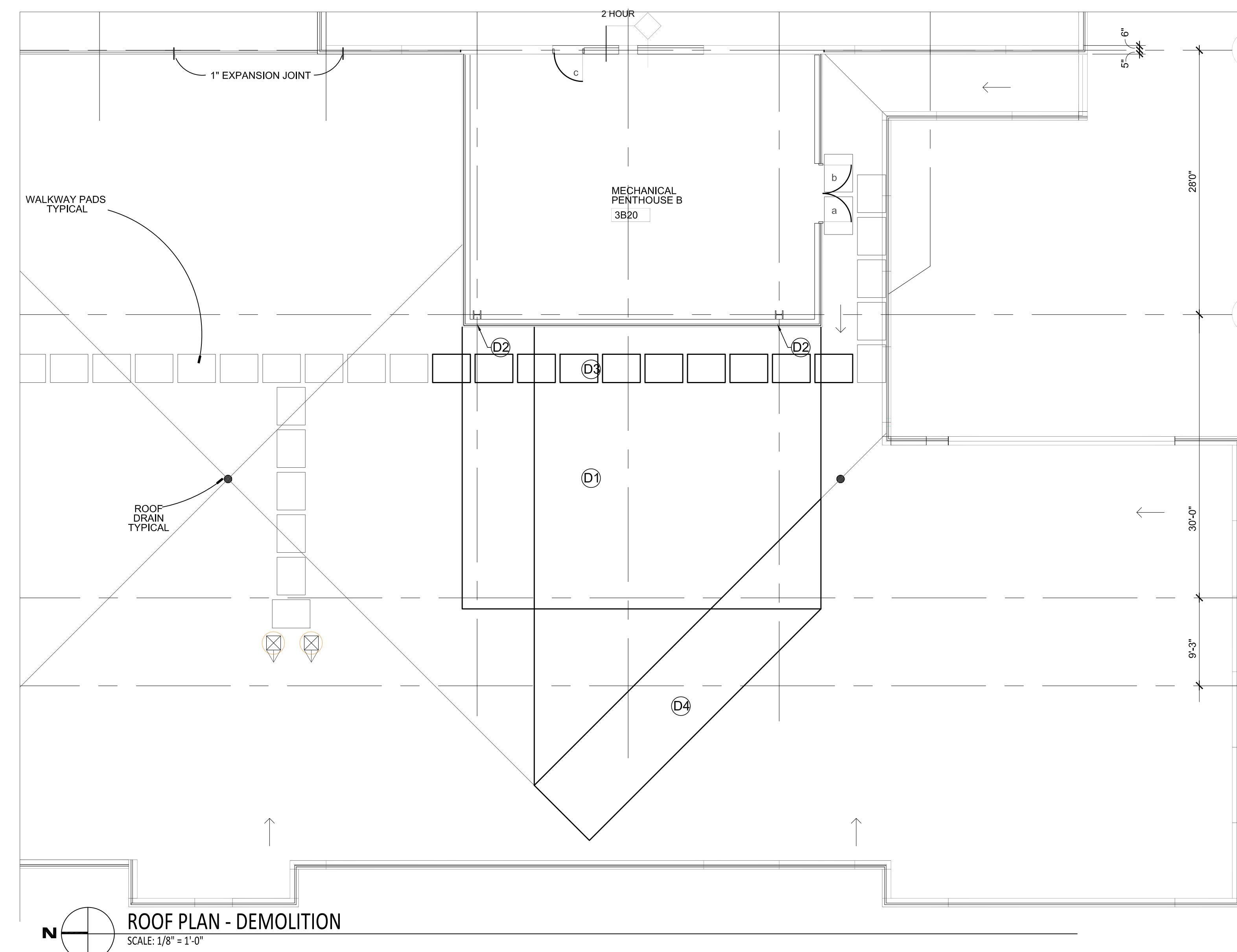
## KEYED PLAN NOTES

- 1 TAPERED INSULATION OVER 4.3" MINIMUM BASE LAYER AT SCUPPERS
- 2 SCUPPER SEE DETAIL 6/A201
- 3 COLLECTION BOX AND DOWNSPOUT SEE DETAIL 5/A201
- 4 TAPERED INSULATION SADDLES TO DIVERT TO SCUPPERS



## DEMOLITION NOTES

- D1 CUT MEMBRANE AND REMOVE INSULATION AT AREA OF NEW PENTHOUSE
- D2 CUT WALL PANELS AS REQUIRED FOR CONNECTION OF NEW STRUCTURE
- D3 REMOVE WALK PADS WITHIN FOOTPRINT
- D4 REMOVE PORTION OF EXISTING MEMBRANE ROOFING FOR MODIFICATION OF TAPERED INSULATION SADDLE



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## ROOF PLAN - DEMOLITION/DETAILS

### SATELLITE JAIL HVAC REPLACEMENT

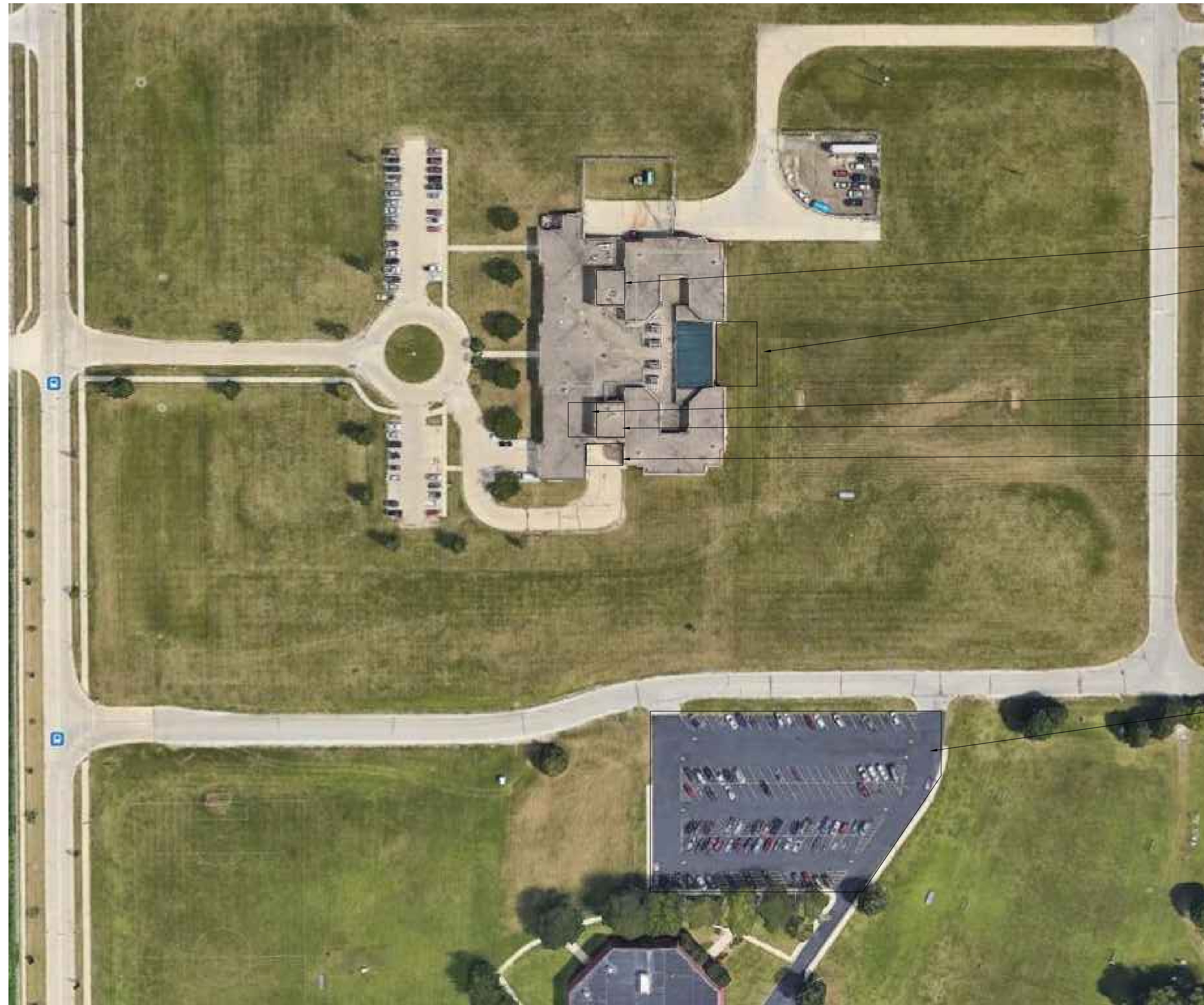
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A-201



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NORTH PENTHOUSE  
 CRANE LOCATION  
 NEW PENTHOUSE  
 SOUTH PENTHOUSE  
 TRAILER LOCATION

PARKING

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**SITE PLAN**  
**SATELLITE JAIL HVAC REPLACEMENT**  
 CHAMPAIGN COUNTY  
 502 S UERMAN AVE URBANA, IL 61802

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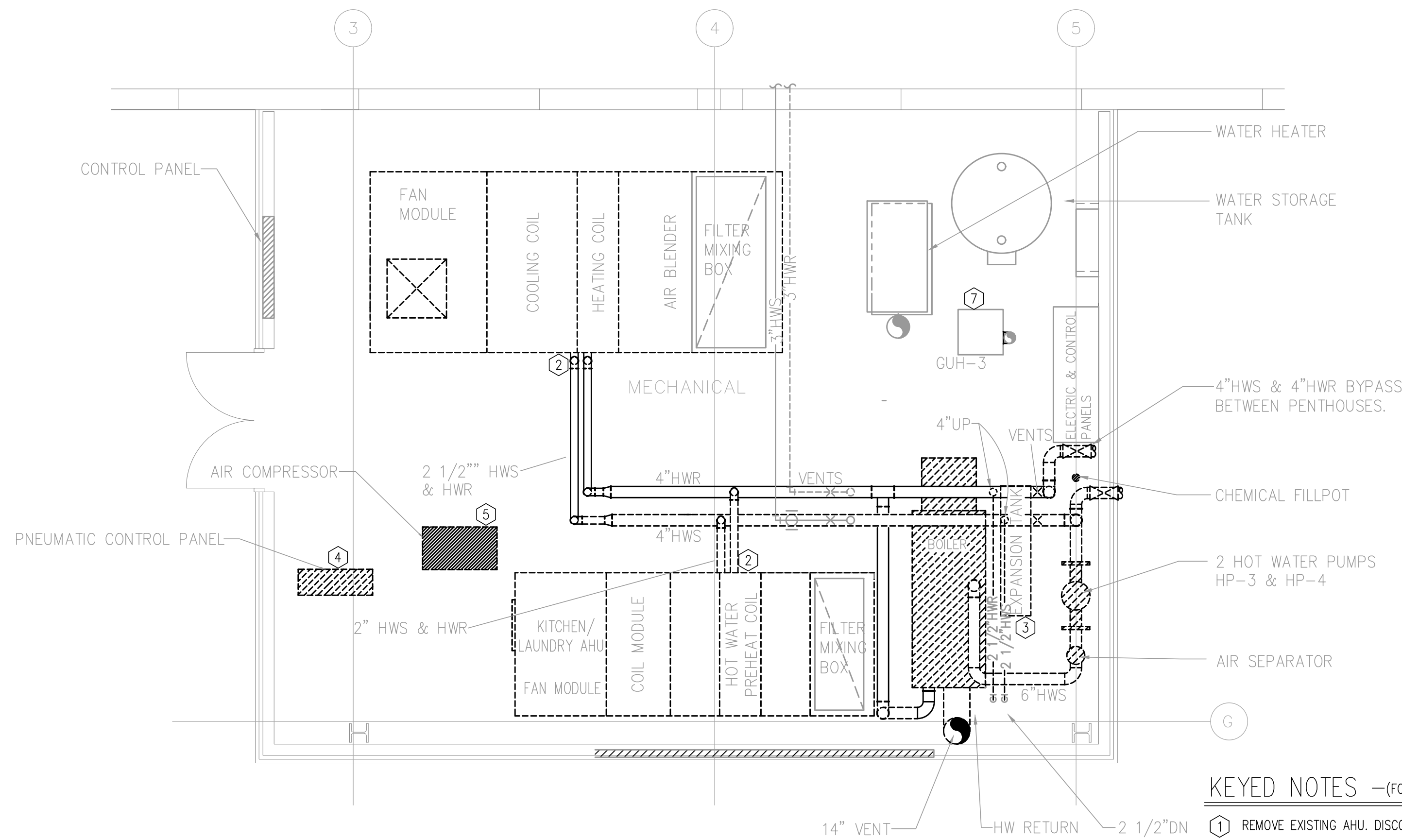
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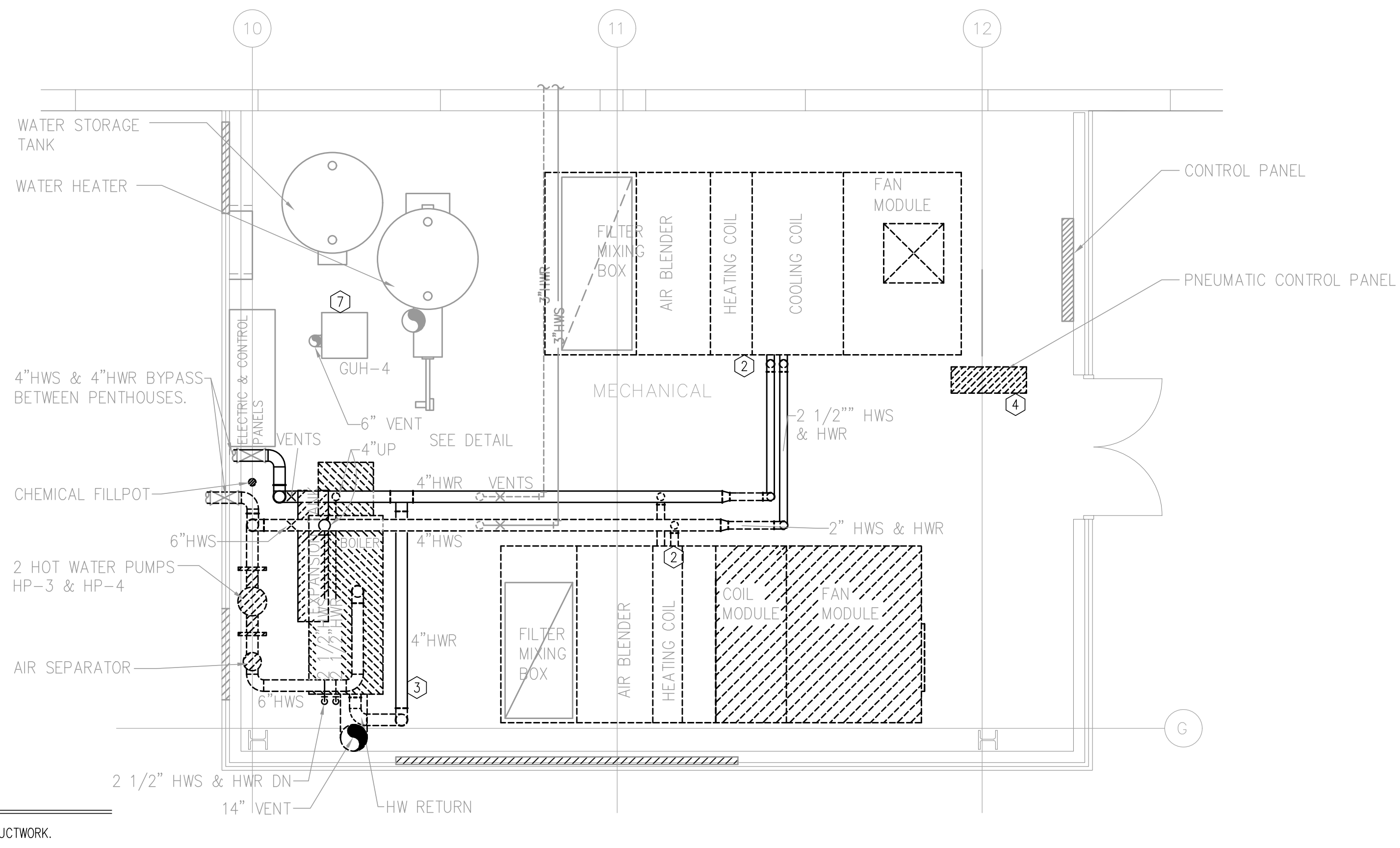




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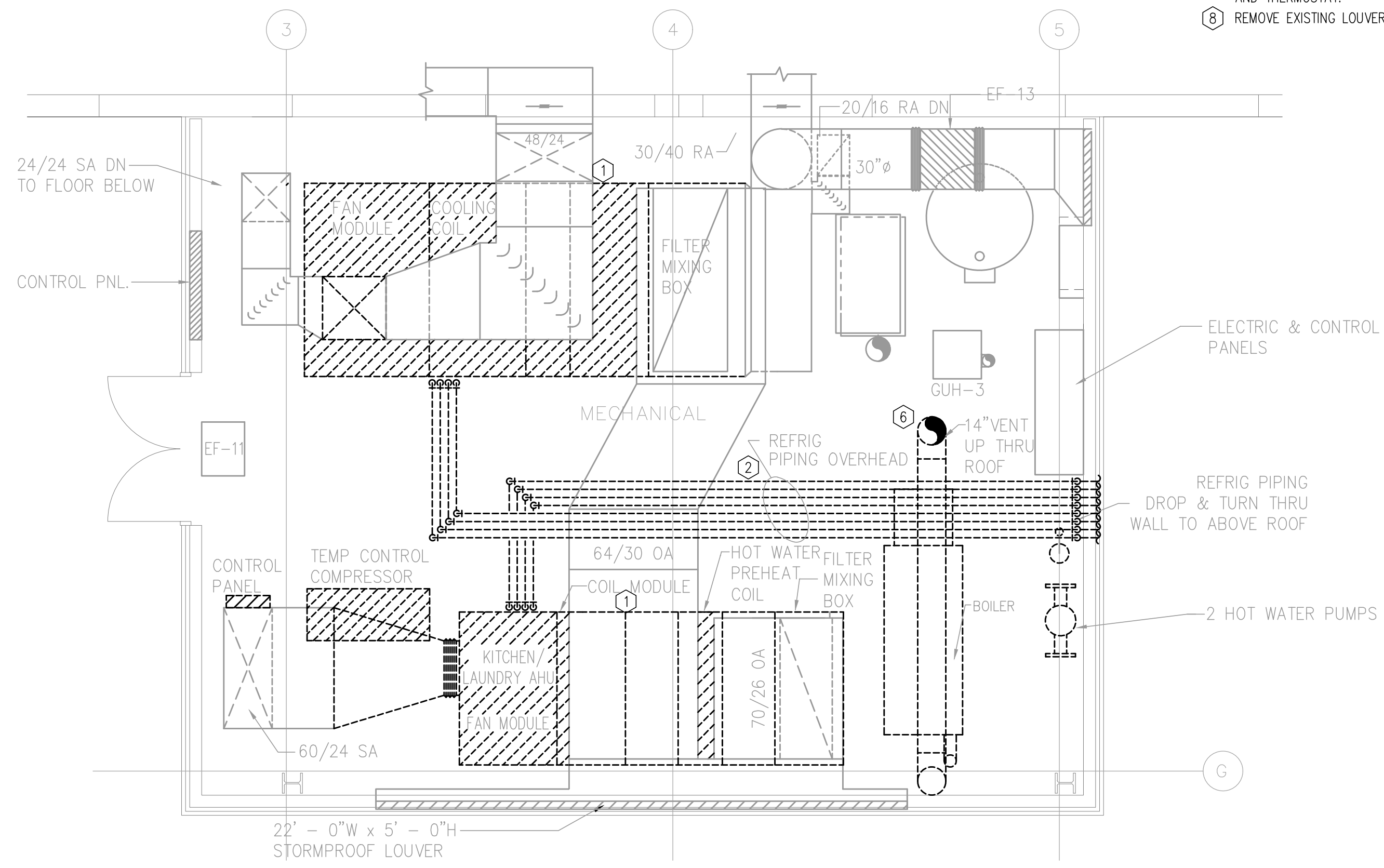


**ENLARGED MECHANICAL ROOM PLAN - NORTH - HEATING DEMO**  
 SCALE: 1/4" = 1'-0"

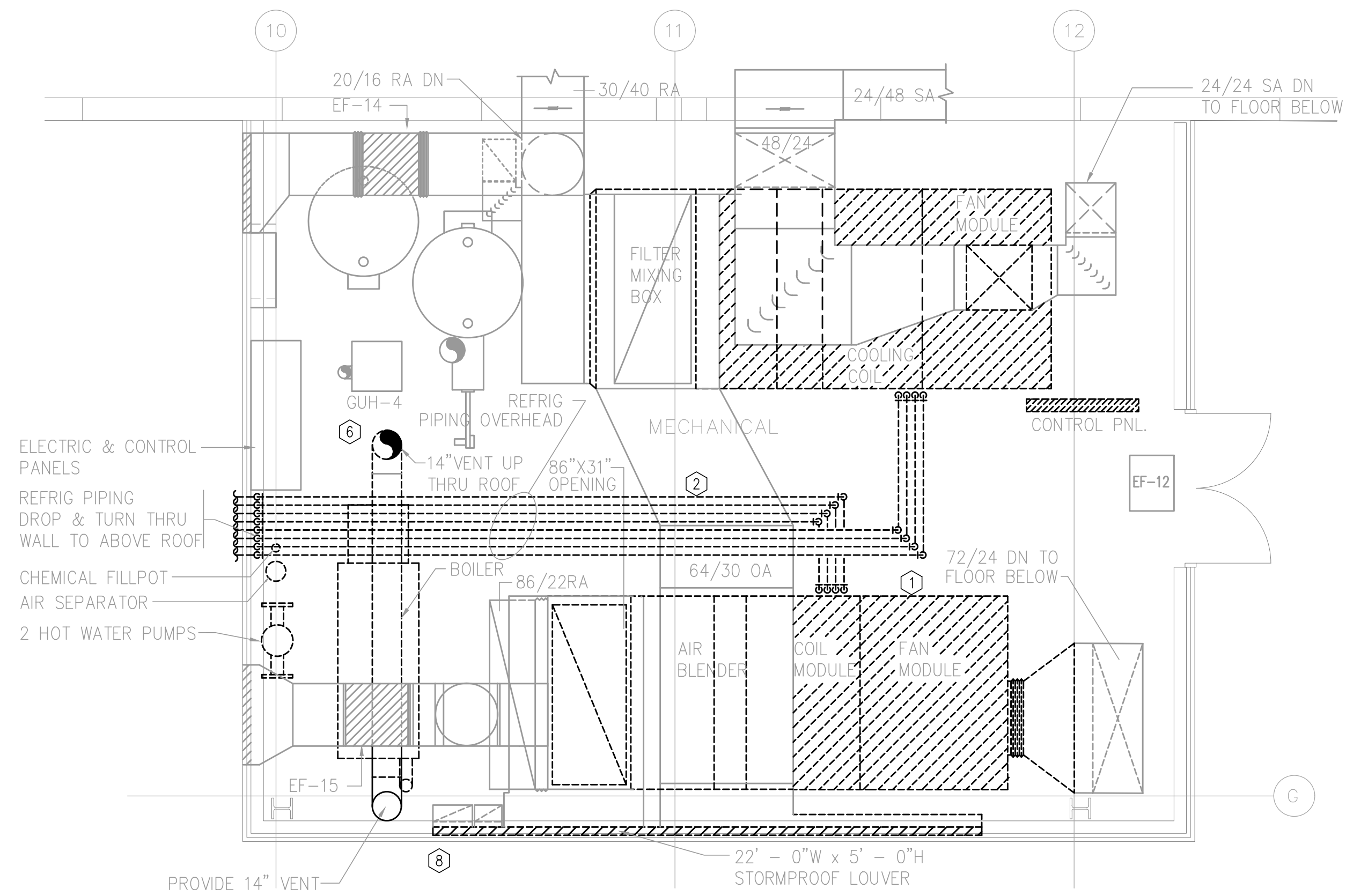


**ENLARGED MECHANICAL ROOM PLAN - SOUTH - HEATING DEMO**  
 SCALE: 1/4" = 1'-0"

- KEYED NOTES** —(FOR THIS PLAN ONLY ○ SYMBOL)
- ① REMOVE EXISTING AHU. DISCONNECT FROM SUPPLY, RETURN AND OA DUCTWORK.
  - ② DISCONNECT HW & REFRIGERANT PIPING FROM AHU. REMOVE ALL ASSOCIATED PIPING FROM PENTHOUSE.
  - ③ REMOVE EXISTING HOT WATER BOILER AND ASSOCIATED BOILER PUMPS. REMOVE ASSOCIATED AIR SEPARATOR AND SHOT FEEDER.
  - ④ REMOVE PNEUMATIC CONTROL PANEL.
  - ⑤ REMOVE PNEUMATIC AIR COMPRESSOR.
  - ⑥ REMOVE EXISTING BOILER FLUE THROUGH ROOF. PATCH PENTHOUSE ROOF.
  - ⑦ GAS FIRED UNIT HEATER TO REMAIN. REPLACE EXISTING ASSOCIATED CONTROLLER AND THERMOSTAT.
  - ⑧ REMOVE EXISTING LOUVERS. PATCH PENTHOUSE WALL.



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



**ENLARGED MECHANICAL ROOM PLAN - SOUTH - VENTILATION DEMO**  
 SCALE: 1/4" = 1'-0"

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**ENLARGED FLOOR PLANS - HVAC - DEMO**  
**SATELLITE JAIL HVAC REPLACEMENT**

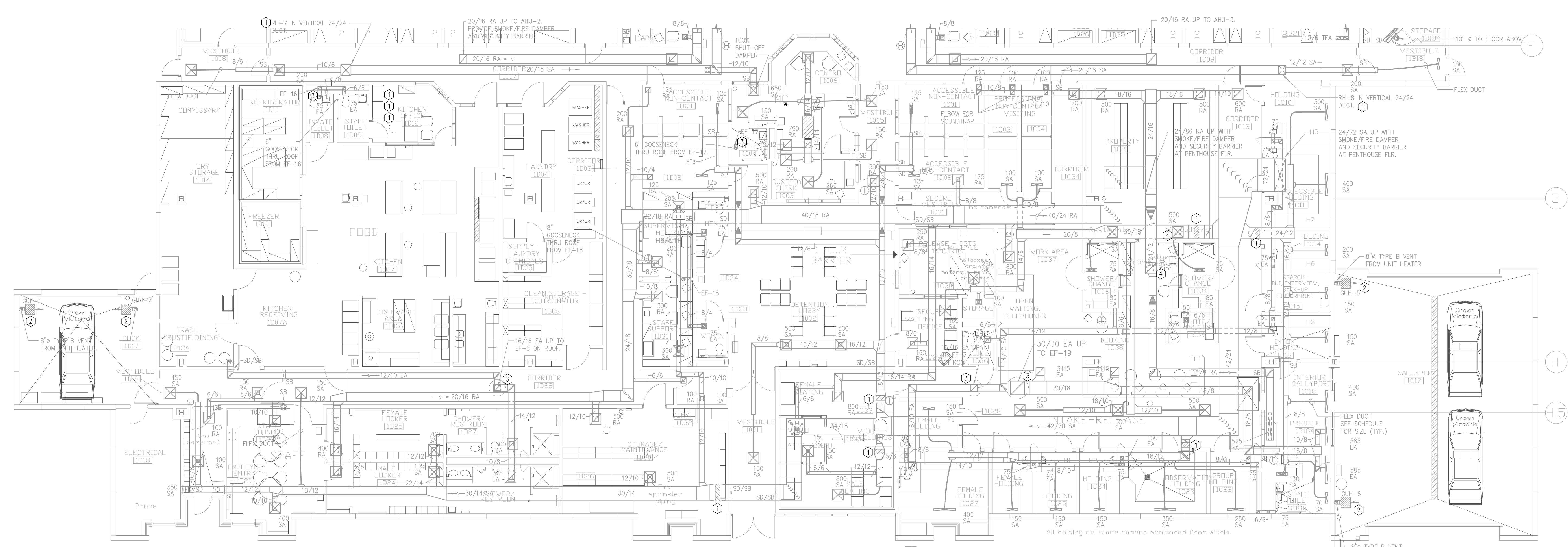
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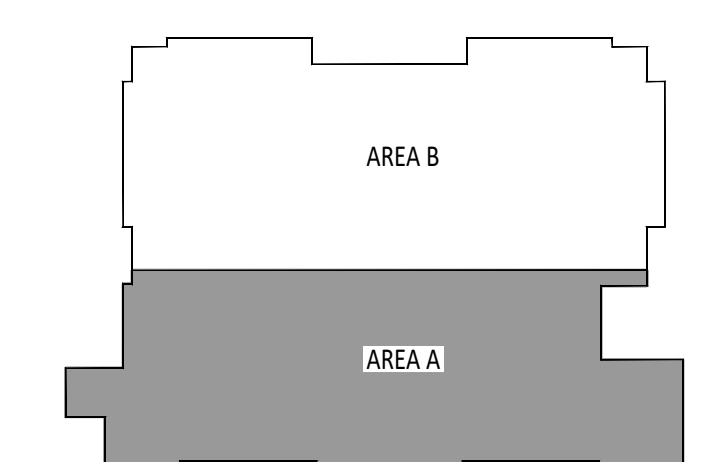


KEYED NOTES —(FOR THIS PLAN ONLY) (SYMBOL)

- ① DUCTED REHEAT COIL TO REMAIN. REPLACE EXISTING CONTROL VALVE AND ACTUATOR. REPLACE ASSOCIATED CONTROLLER AND THERMOSTAT. FOR DUCTED REHEAT COIL CONTROLS WORK SEE DETAIL. REMOVE PNEUMATIC PIPING LOCALLY AND CAP. (7 M-500)
- ② GAS FIRED UNIT HEATER TO REMAIN. REPLACE EXISTING ASSOCIATED CONTROLLER AND THERMOSTAT. FOR GAS FIRED UNIT HEATER CONTROLS WORK SEE DETAIL. (7 M-500)
- ③ EXISTING EF TO REMAIN. REPLACE EXISTING ASSOCIATED CONTROLLER. FOR EF CONTROLS WORK SEE DETAIL. PROVIDE START/STOP. (7 M-500)



**FIRST FLOOR PLAN - AREA A - HVAC**  
SCALE: 1/8" = 1'-0"



**KEY PLAN**  
NO SCALE

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**FIRST FLOOR PLAN - AREA A - HVAC**  
**SATELLITE JAIL HVAC REPLACEMENT**  
CHAMPAIGN COUNTY  
502 S LIERMAN AVE URBANA, IL 61802

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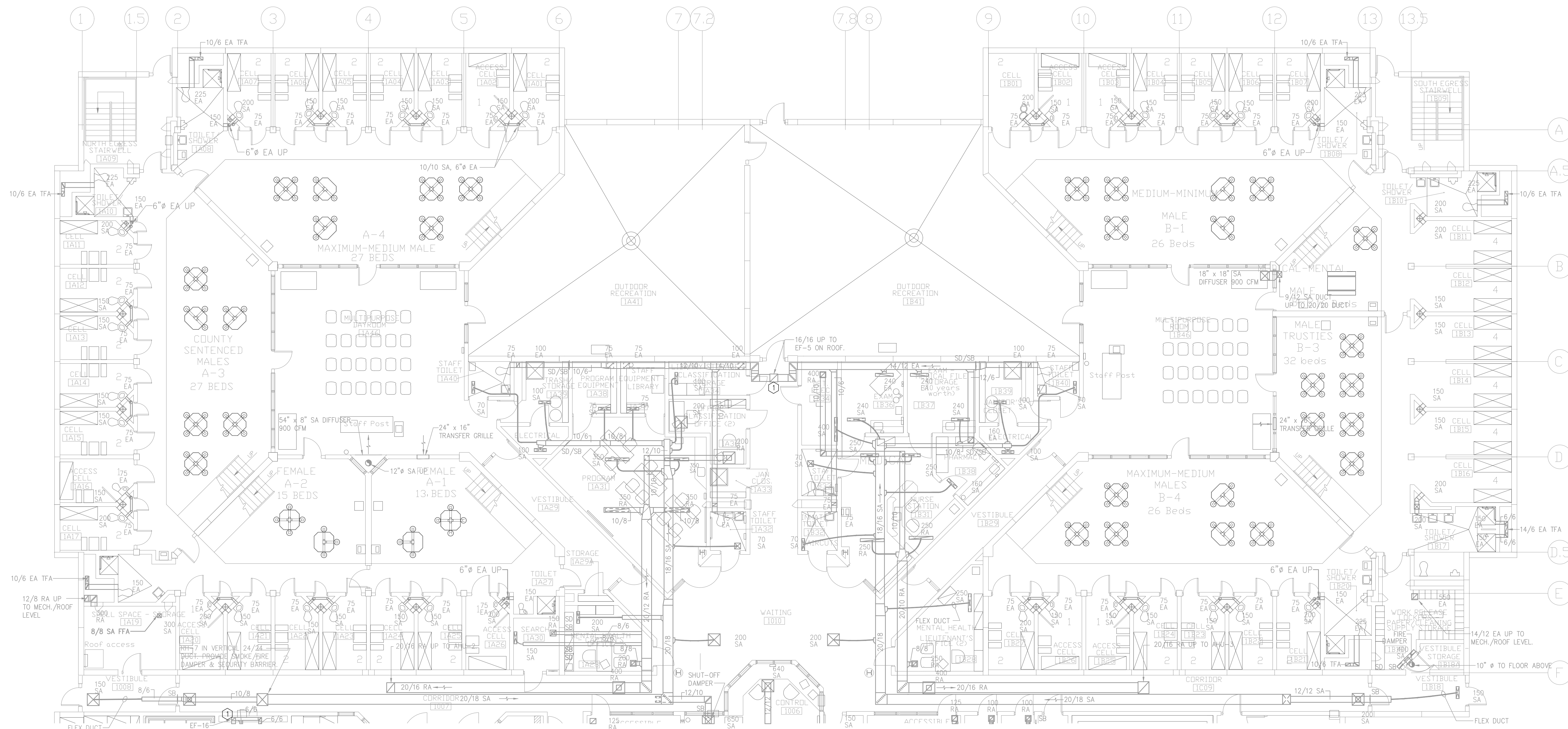
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**M-101A**

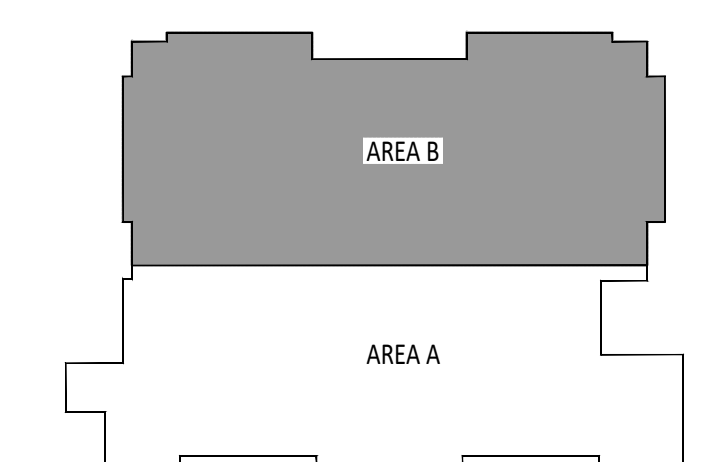
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KEYED NOTES —(FOR THIS PLAN ONLY) (SYMBOL)

- 1 EXISTING EF TO REMAIN. REPLACE EXISTING ASSOCIATED CONTROLLER. FOR EF CONTROLS WORK SEE DETAIL.
- 7 PROVIDE START/STOP.




FIRST FLOOR PLAN - AREA B - HVAC  
SCALE: 1/8" = 1'-0"



KEY PLAN  
NO SCALE

H:\GHR Projects\Champaign County Satellite Jail - Mechanical Upgrade\HVAC\01 - Worksheets\7253 - M-101B.dwg  
 PRINTED: 04/23/2021 10:58 AM

NO.	DESCRIPTION


**ENGINEERS AND ASSOCIATES, INC.**  
 Mechanical & Electrical Consulting Engineers  
 1615 South Neil Street, Champaign, Illinois 61820  
 217-356-0536 Business - 217-356-1092 Fax

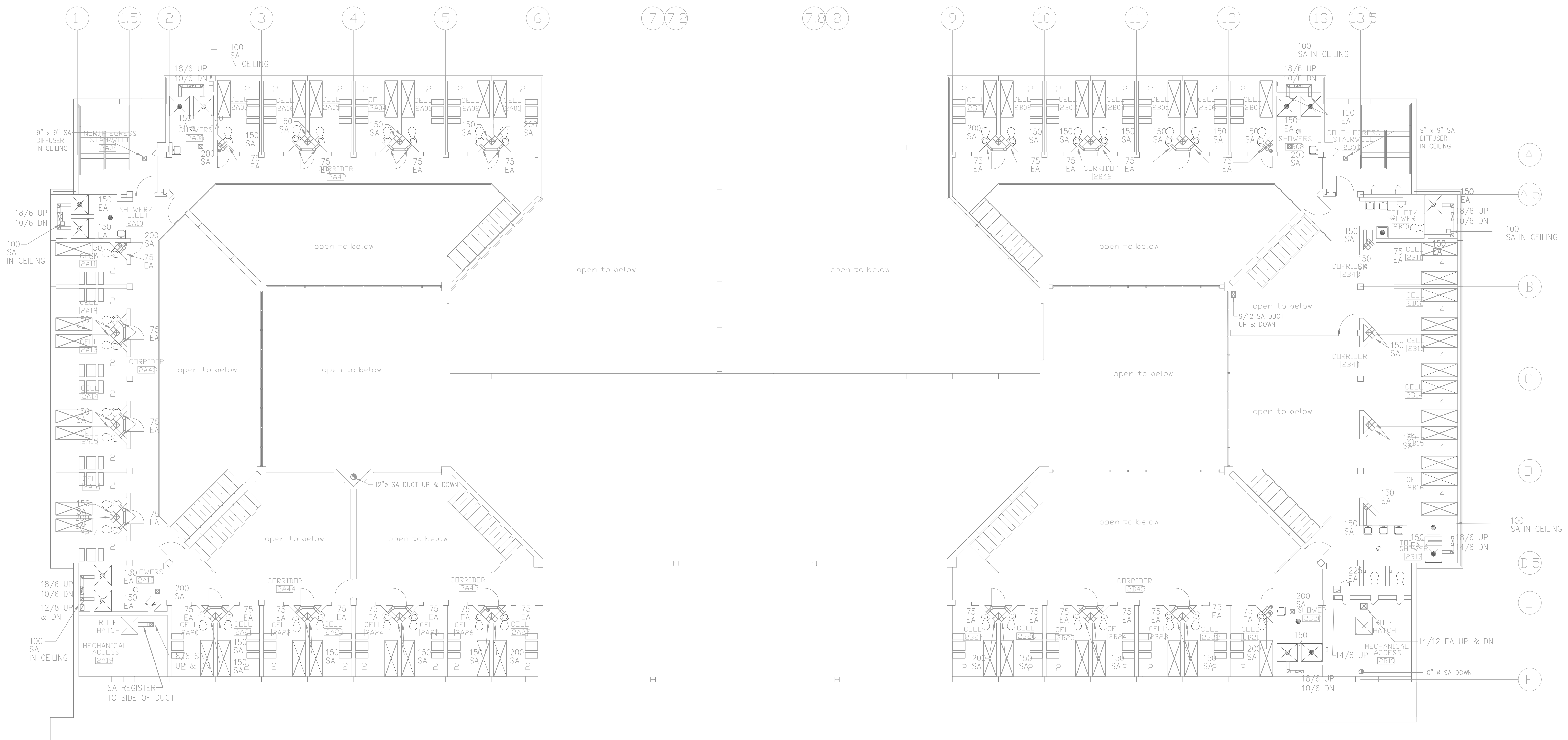
**SATELLITE JAIL HVAC REPLACEMENT**

CHAMPAIGN COUNTY  
 502 S LIERMAN AVE URBANA, IL 61802

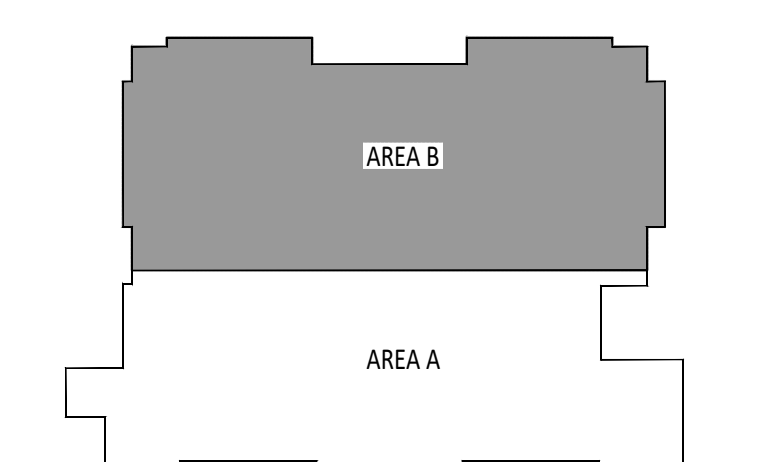
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**M-101B**

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 PRINTED: 04/23/2021



**SECOND FLOOR PLAN - AREA B - HVAC**  
 SCALE: 1/8" = 1'-0"



**KEY PLAN**  
 NO SCALE

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 Mechanical & Electrical Consulting Engineers  
 1615 South Neil Street, Champaign, Illinois 61820  
 217-356-0536 Business - 217-356-1092 Fax

**SECOND FLOOR PLAN - AREA B - HVAC**  
**SATELLITE JAIL HVAC REPLACEMENT**  
 CHAMPAIGN COUNTY  
 502 S LIERMAN AVE URBANA, IL 61802

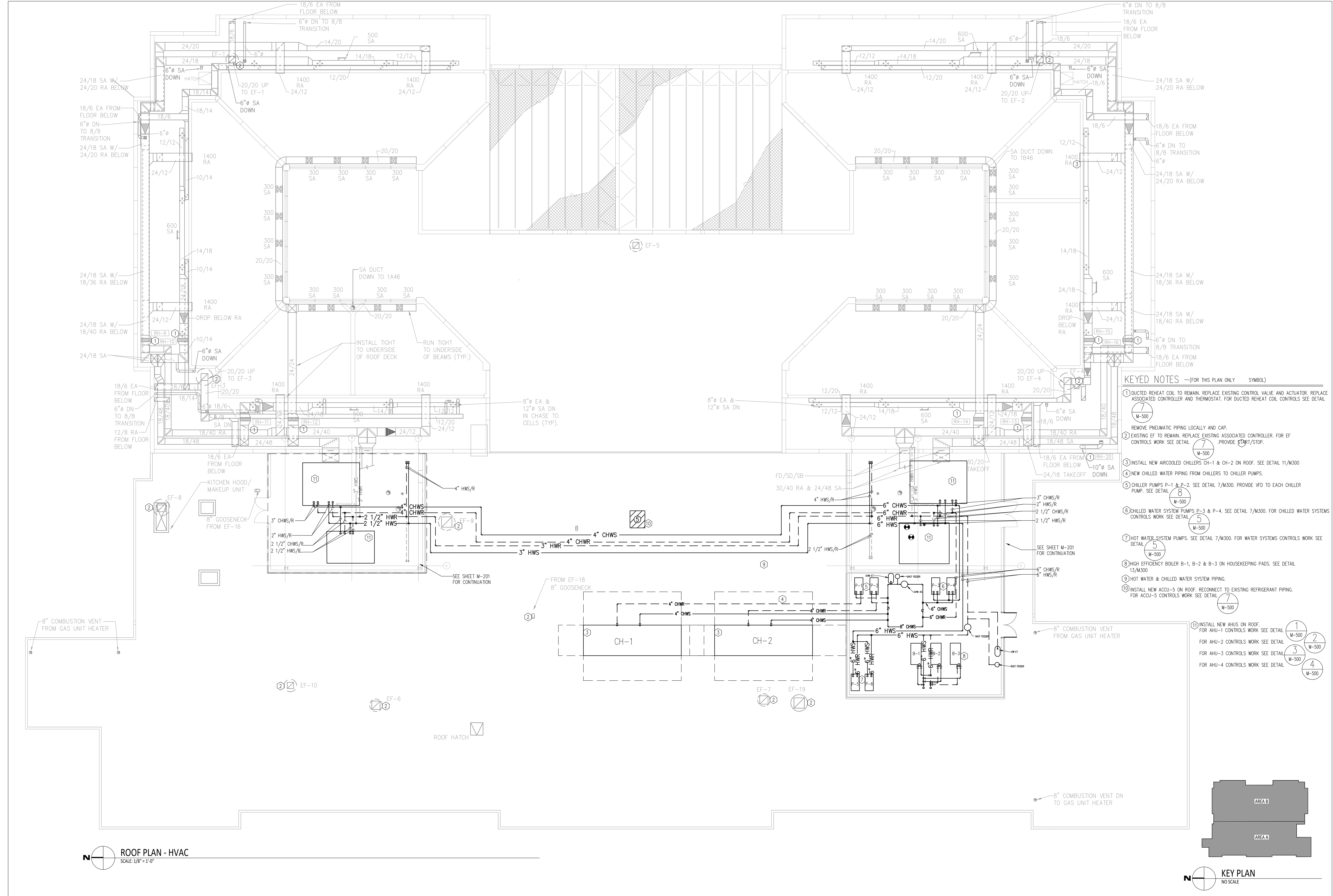
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 95% CD  
 GHR # 7253

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- KEYED NOTES** —(FOR THIS PLAN ONLY) SYMBOL
- DUCTED REHEAT COIL TO REMAIN. REPLACE EXISTING CONTROL VALVE AND ACTUATOR. REPLACE ASSOCIATED CONTROLLER AND THERMOSTAT. FOR DUCTED REHEAT COIL CONTROLS SEE DETAIL M-500
  - EXISTING EF TO REMAIN. REPLACE EXISTING ASSOCIATED CONTROLLER. FOR EF CONTROLS WORK SEE DETAIL M-500. PROVIDE START/STOP.
  - INSTALL NEW AIRCOOLED CHILLERS CH-1 & CH-2 ON ROOF. SEE DETAIL 11/M300
  - NEW CHILLED WATER PIPING FROM CHILLERS TO CHILLER PUMPS.
  - CHILLER PUMPS P-1 & P-2. SEE DETAIL 7/M300. PROVIDE VFD TO EACH CHILLER PUMP. SEE DETAIL M-500
  - CHILLED WATER SYSTEM PUMPS P-3 & P-4. SEE DETAIL 7/M300. FOR CHILLED WATER SYSTEMS CONTROLS WORK SEE DETAIL M-500
  - HOT WATER SYSTEM PUMPS. SEE DETAIL 7/M300. FOR WATER SYSTEMS CONTROLS WORK SEE DETAIL M-500
  - HIGH EFFICIENCY BOILER B-1, B-2 & B-3 ON HOUSEKEEPING PADS. SEE DETAIL 13/M300
  - HOT WATER & CHILLED WATER SYSTEM PIPING.
  - INSTALL NEW ACCU-5 ON ROOF. RECONNECT TO EXISTING REFRIGERANT PIPING. FOR ACCU-5 CONTROLS WORK SEE DETAIL M-500
  - INSTALL NEW AHUS ON ROOF. FOR AHU-1 CONTROLS WORK SEE DETAIL M-500
  - FOR AHU-2 CONTROLS WORK SEE DETAIL M-500
  - FOR AHU-3 CONTROLS WORK SEE DETAIL M-500
  - FOR AHU-4 CONTROLS WORK SEE DETAIL M-500

**ROOF PLAN - HVAC**  
 SCALE: 1/8" = 1'-0"

**KEY PLAN**  
 NO SCALE

DATE	NO.	DESCRIPTION

**GHR ENGINEERS AND ASSOCIATES, INC.**  
 Mechanical & Electrical Consulting Engineers  
 1615 South Neil Street, Champaign, Illinois 61820  
 217-356-0536 Business - 217-356-1092 Fax

**ROOF PLAN - HVAC**  
**SATELLITE JAIL HVAC REPLACEMENT**  
 CHAMPAIGN COUNTY  
 502 S LIERMAN AVE URBANA, IL 61802

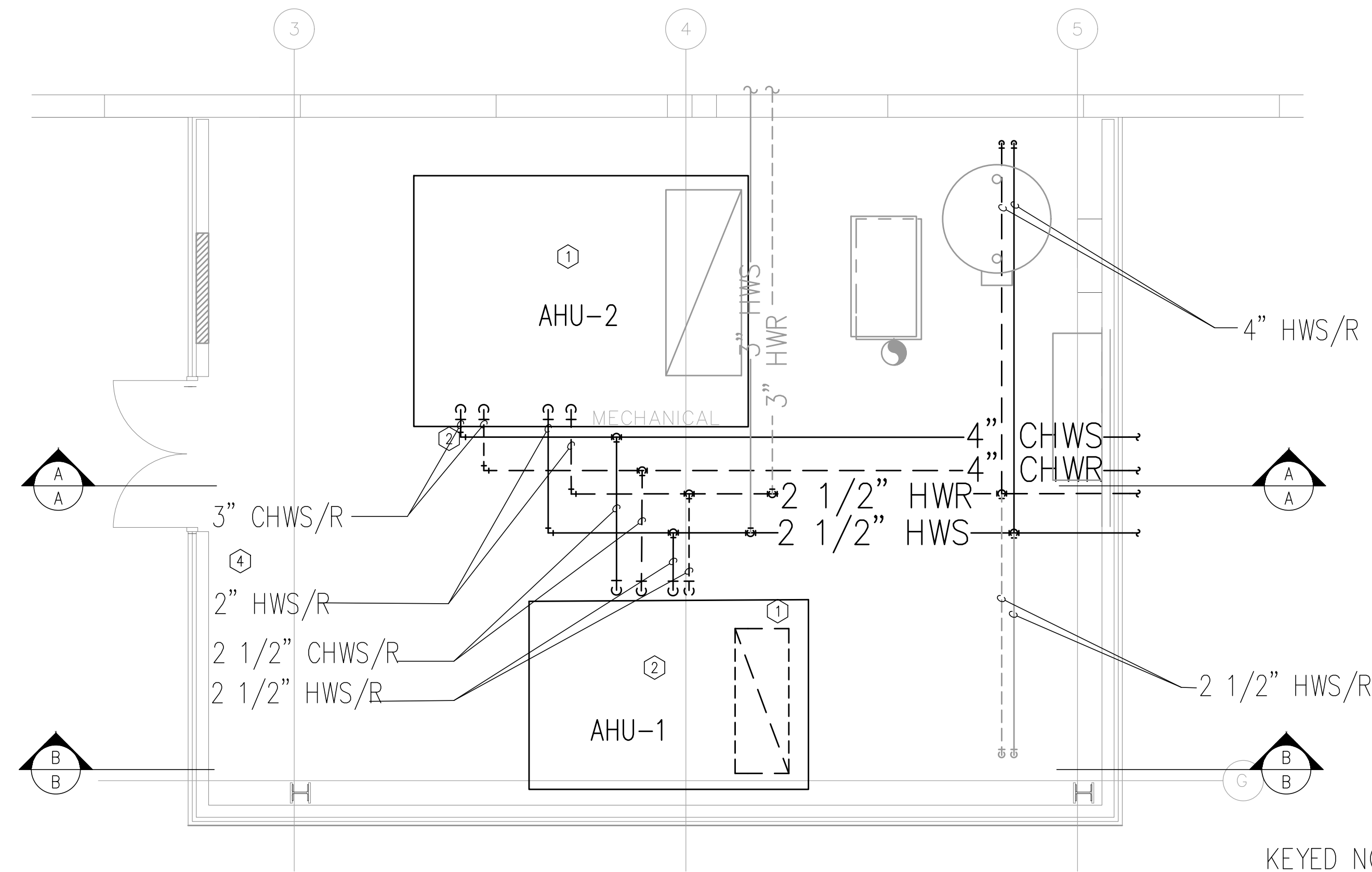
DATE	JMD	APPROVED	RCVN	SHEET:

**M-103**

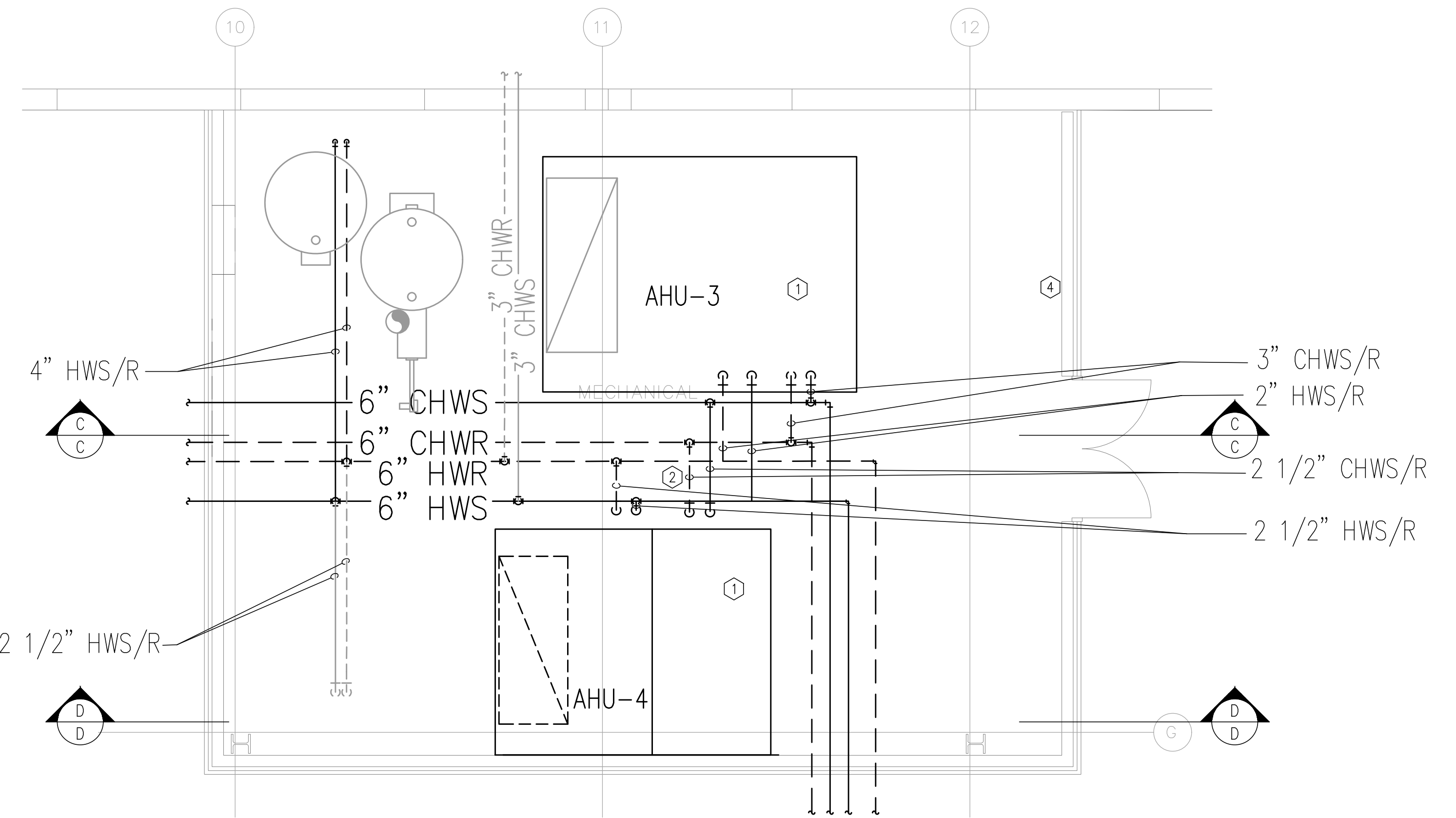
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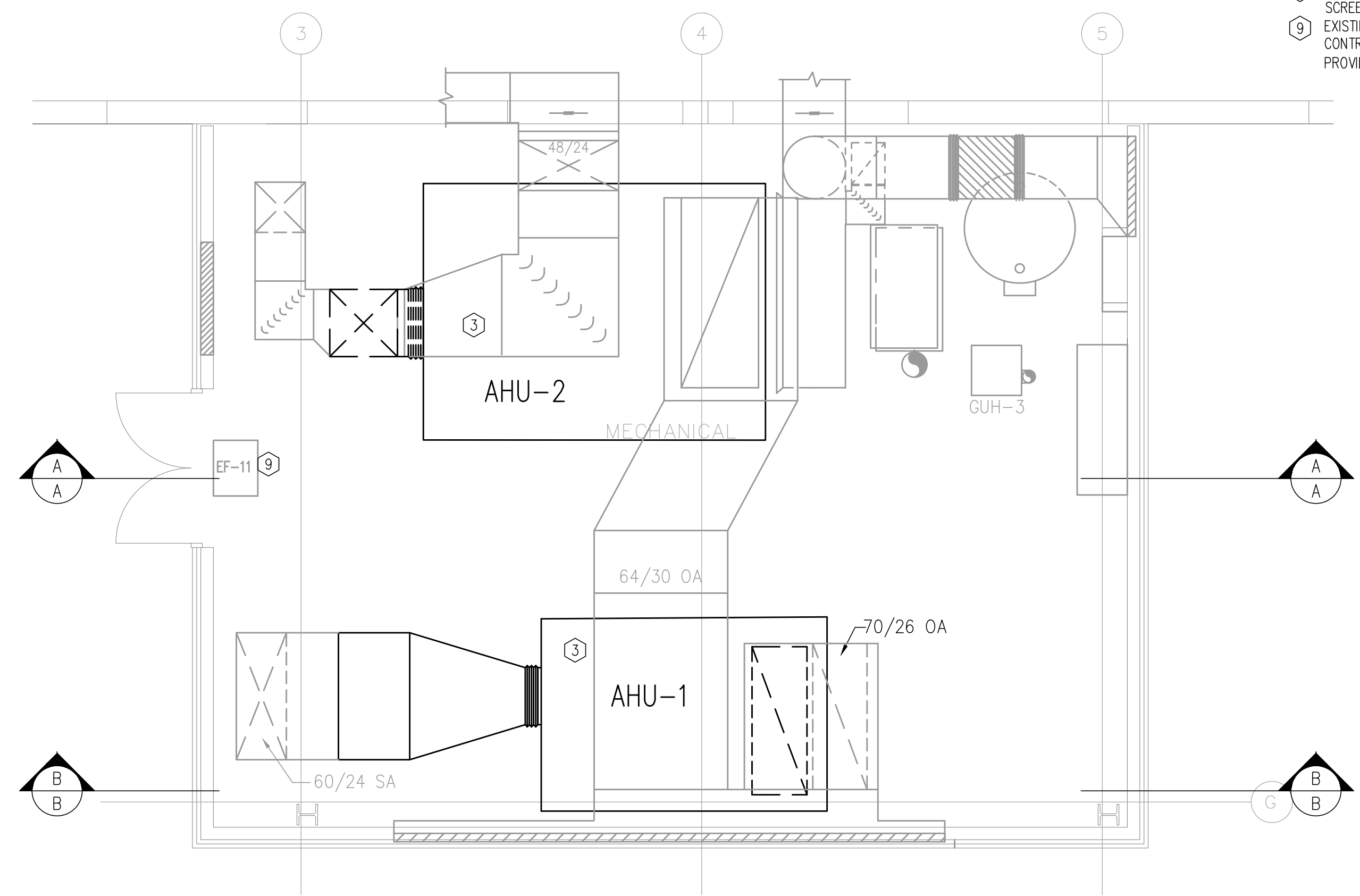
**ENLARGED MECHANICAL ROOM PLAN - NORTH - HEATING**  
 SCALE: 1/4" = 1'-0"



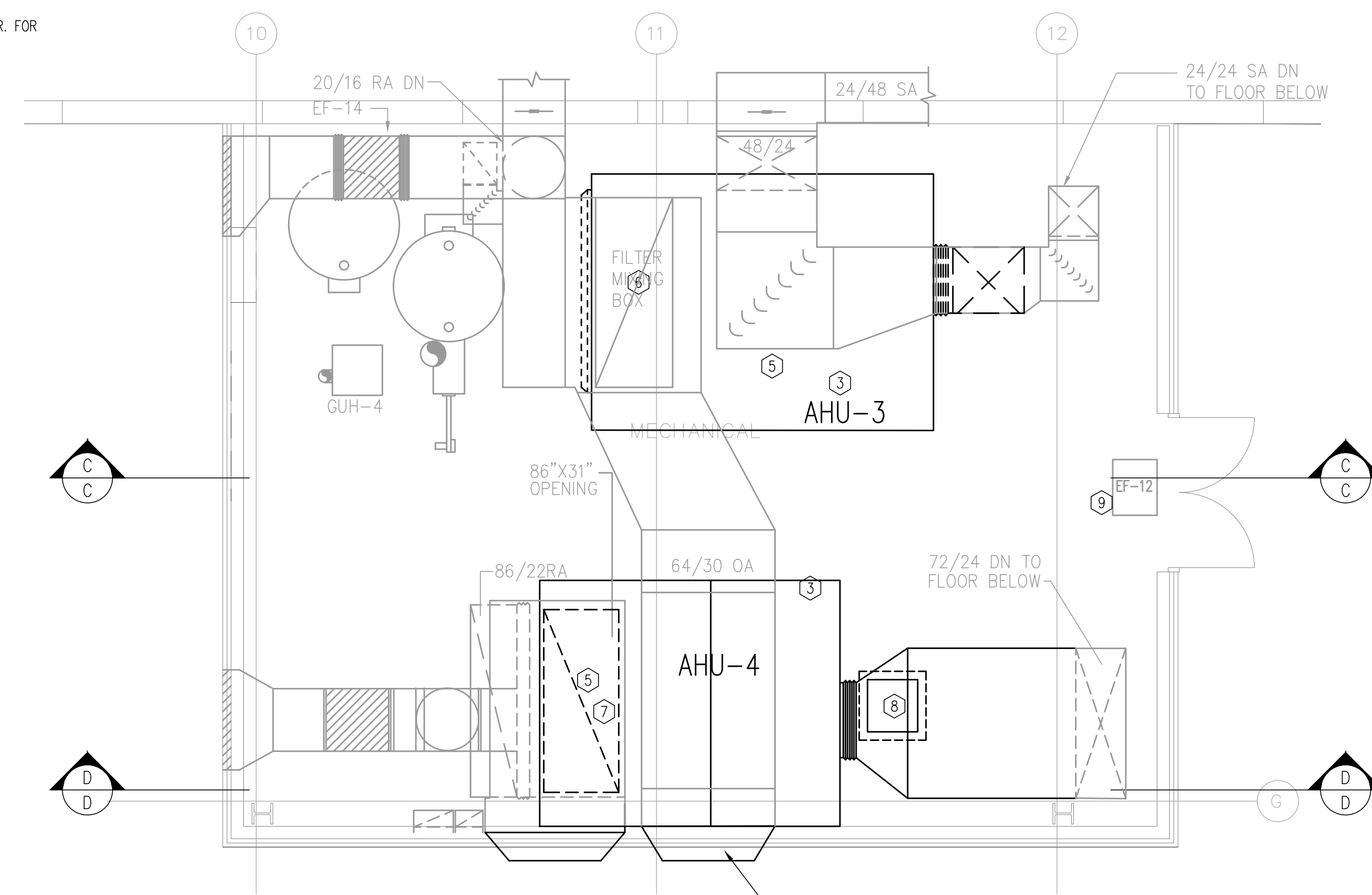
**ENLARGED MECHANICAL ROOM PLAN - SOUTH - HEATING**  
 SCALE: 1/4" = 1'-0"

**KEYED NOTES** — (FOR THIS PLAN ONLY) SYMBOL

- ① INSTALL NEW AHU ON HOUSEKEEPING PAD
- ② CONNECT NEW CHWS,R & HWS,R PIPING FOR NEW AHU
- ③ CONNECT NEW AHU TO EXISTING SA, RA & RA DUCTWORK.
- ④ INSTALL NEW CONTROL PANEL.
- ⑤ EXTEND OA DUCT INTO PENTHOUSE. TURN OA DUCT VERTICALLY TO NEW ROOF HOODS ON PENTHOUSE.
- ⑥ NEW 44"x70" ROOF HOOD FOR OUTSIDE AIR. CURB CAP WIDTH AND LENGTH 52"x78".
- ⑦ NEW 44"x60" ROOF HOOD FOR OUTSIDE AIR. CURB CAP WIDTH AND LENGTH 52"x68".
- ⑧ NEW 25"x24" ROOF HOOD. CURB CAP WIDTH AND LENGTH 33"x32". PROVIDE MOD. PROVIDE MESH SCREEN.
- ⑨ EXISTING EF TO REMAIN. REPLACE EXISTING ASSOCIATED CONTROLLER. FOR CONTROLS WORK SEE DETAIL M-500.



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



**ENLARGED MECHANICAL ROOM PLAN - SOUTH - VENTILATION**  
 SCALE: 1/4" = 1'-0"

DATE	NO.	DESCRIPTION

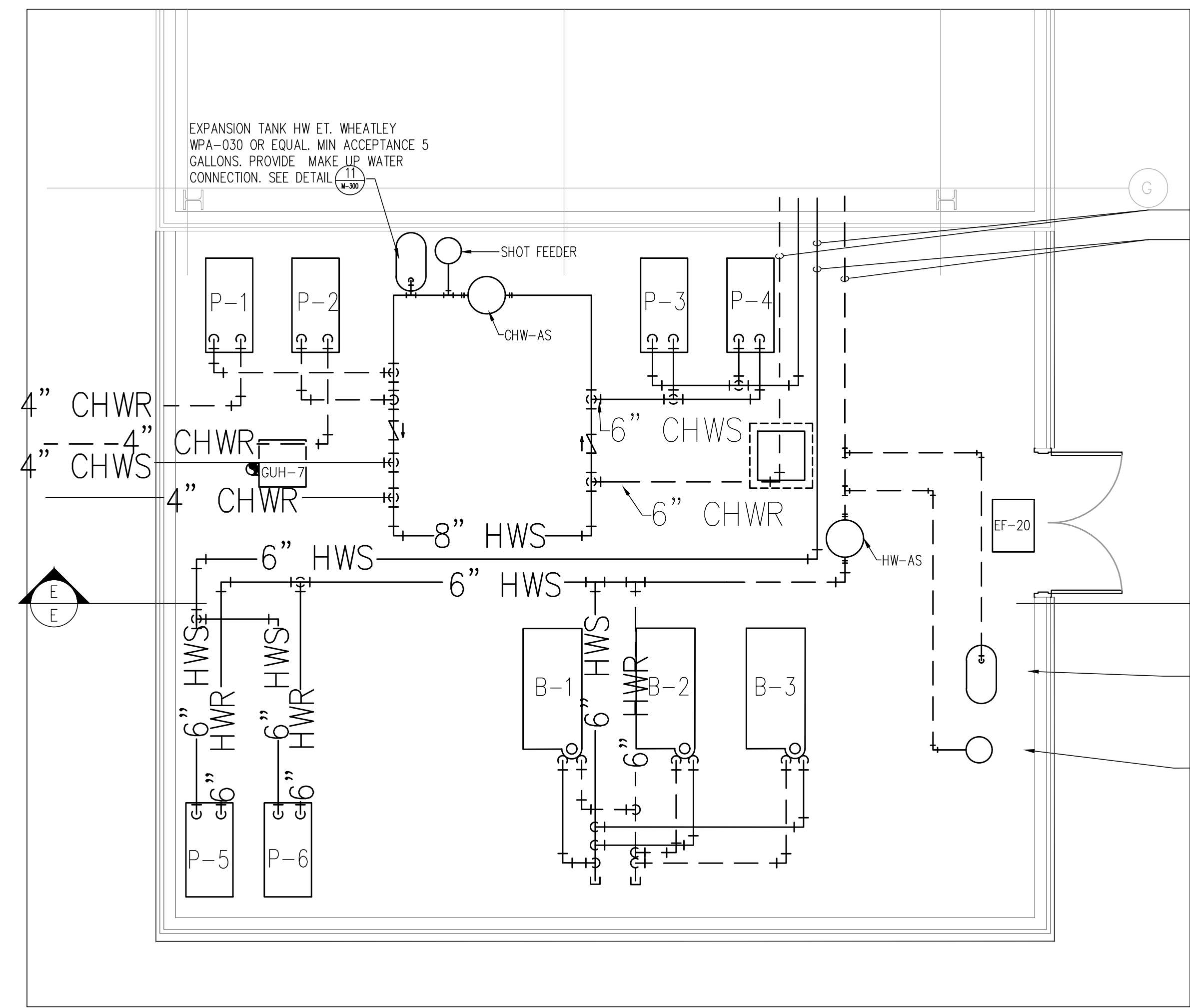
**GHR ENGINEERS AND ASSOCIATES, INC.**  
 Mechanical & Electrical Consulting Engineers  
 1615 South Neil Street, Champaign, Illinois 61820  
 217-356-0536 Business - 217-356-1092 Fax

**ENLARGED FLOOR PLANS - HVAC**  
**SATELLITE JAIL HVAC REPLACEMENT**  
 CHAMPAIGN COUNTY  
 502 S LIERMAN AVE URBANA, IL 61802

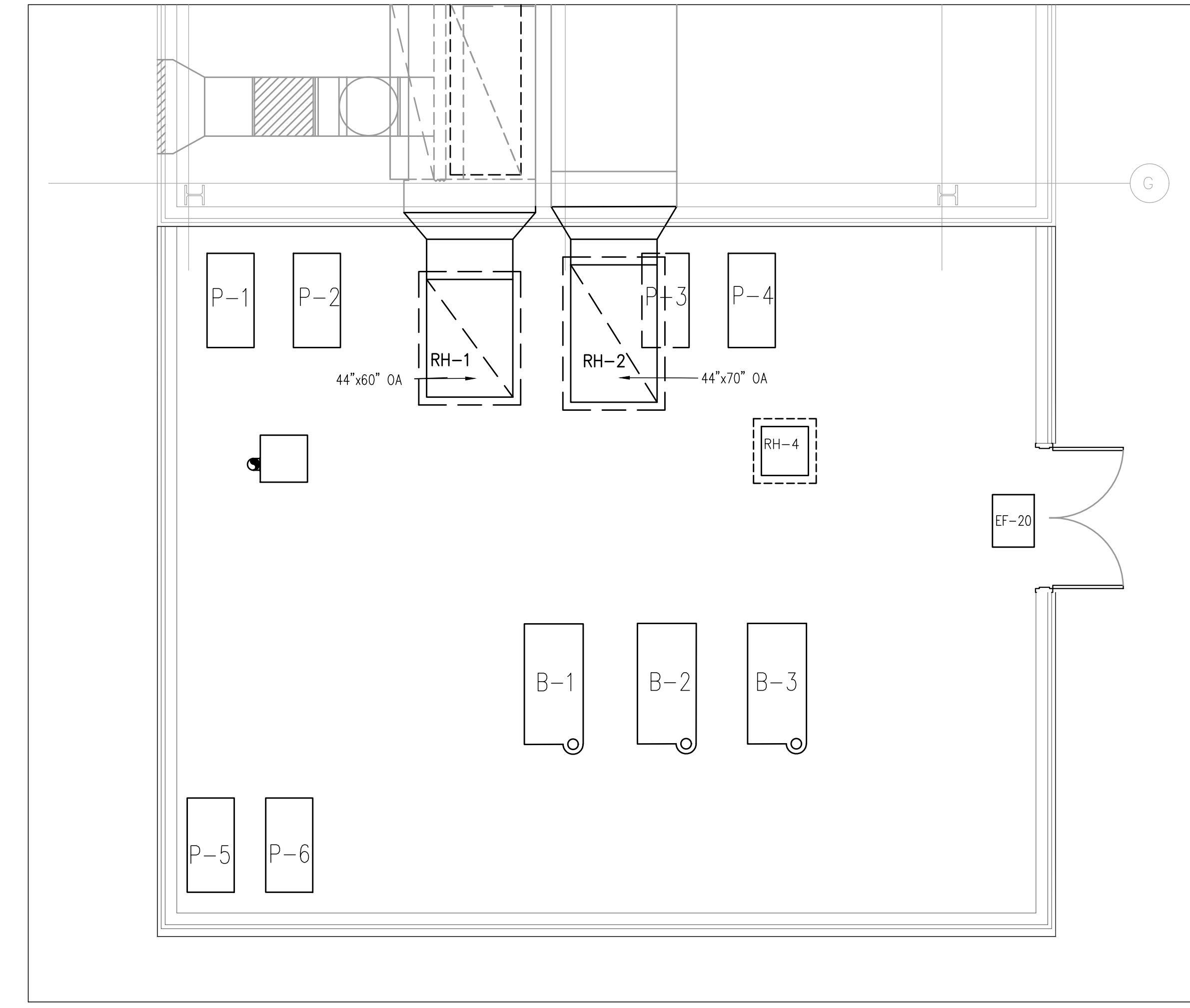
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DATE	APRIL 23, 2021			<b>M-201</b>
PROJECT	95% CD			
PROJECT	GHR # 7253			

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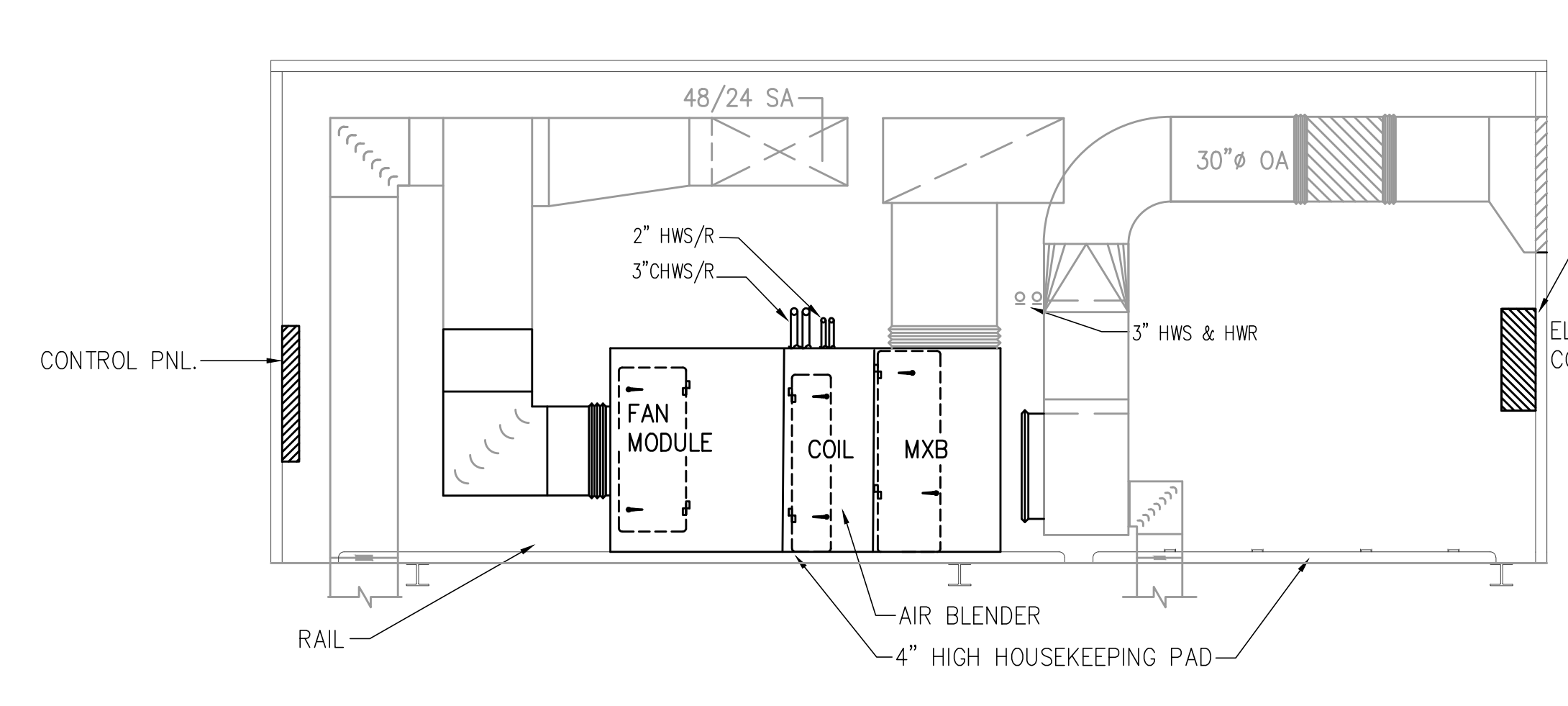
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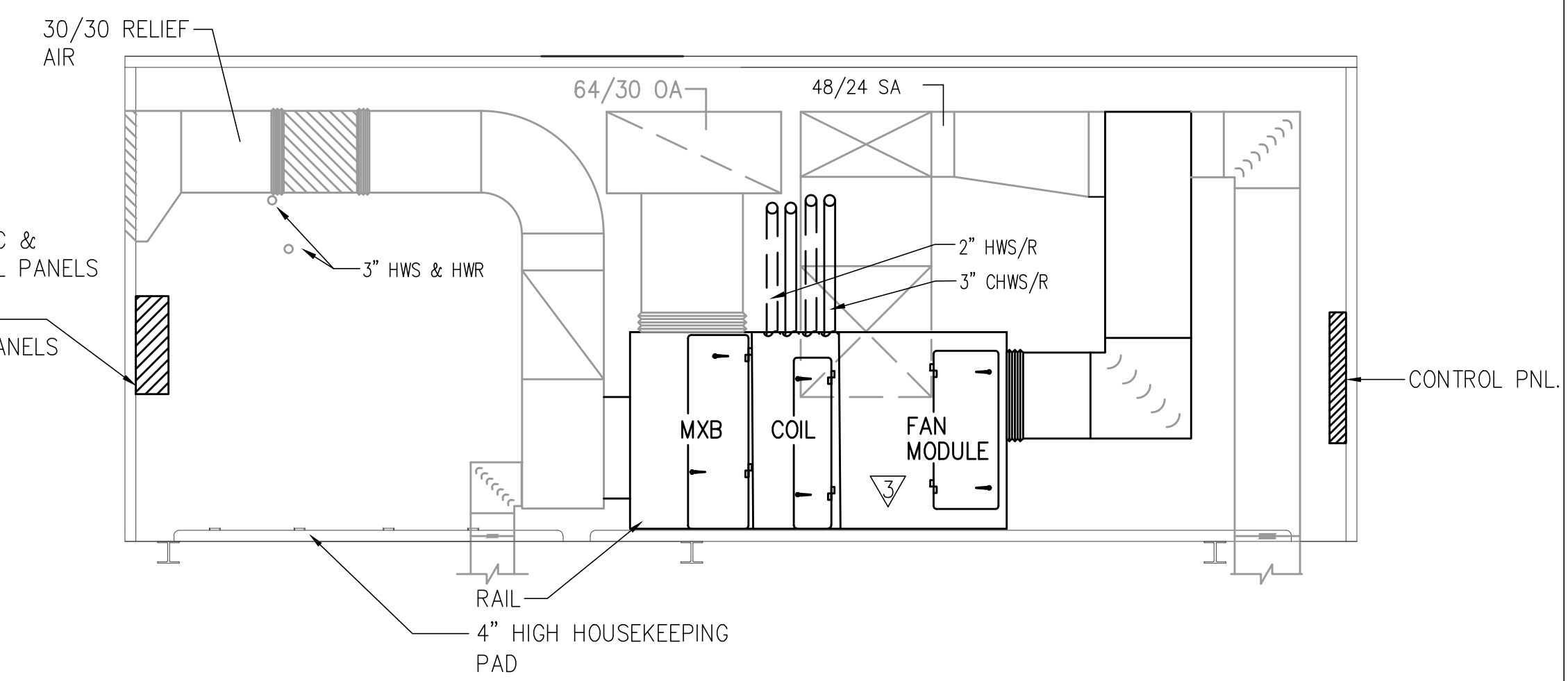
**ENLARGED NEW PENTHOUSE PLAN - HEATING**  
 SCALE: 1/4" = 1'-0"



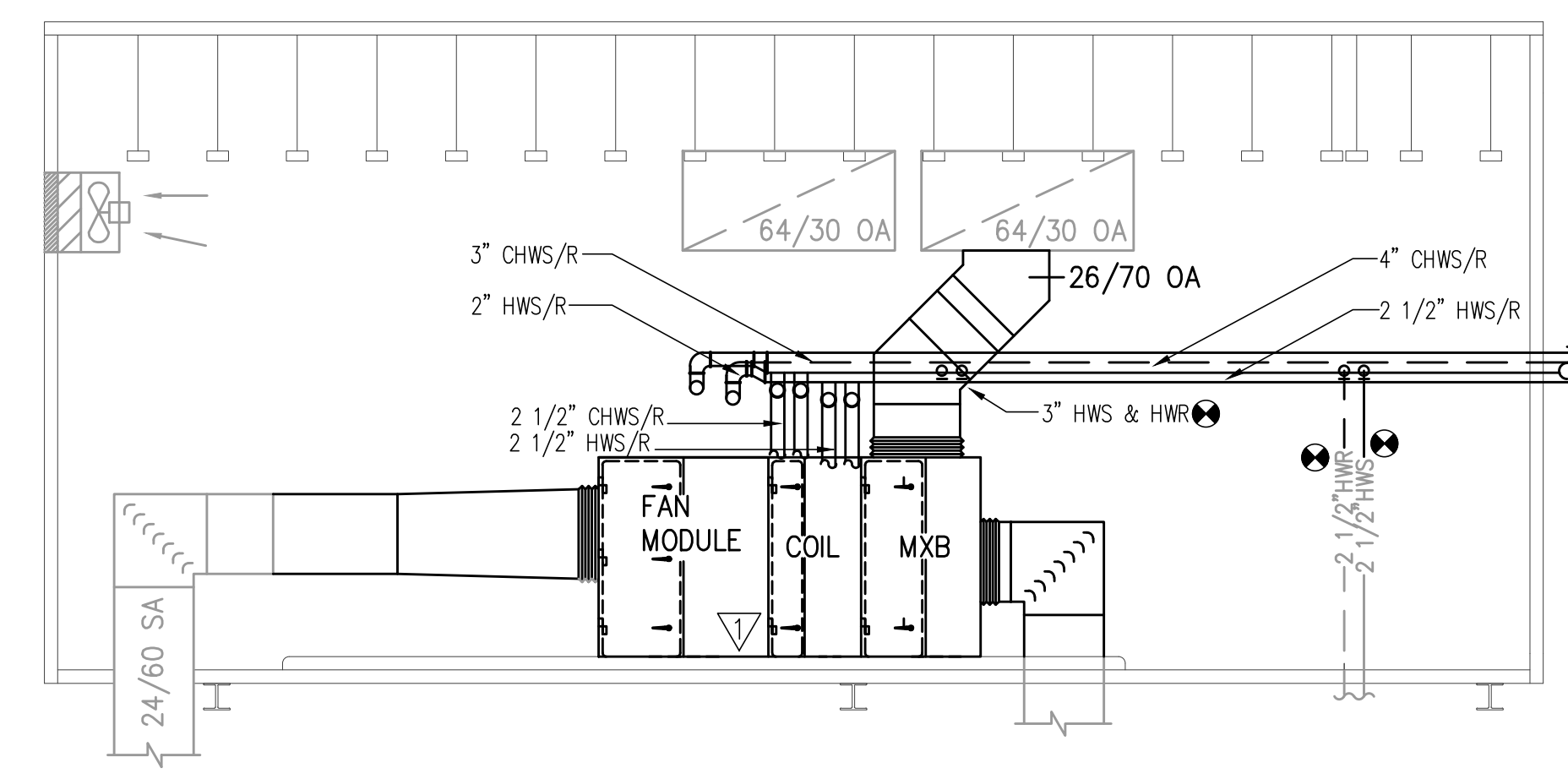
**ENLARGED NEW PENTHOUSE PLAN - VENTILATION**  
 SCALE: 1/4" = 1'-0"



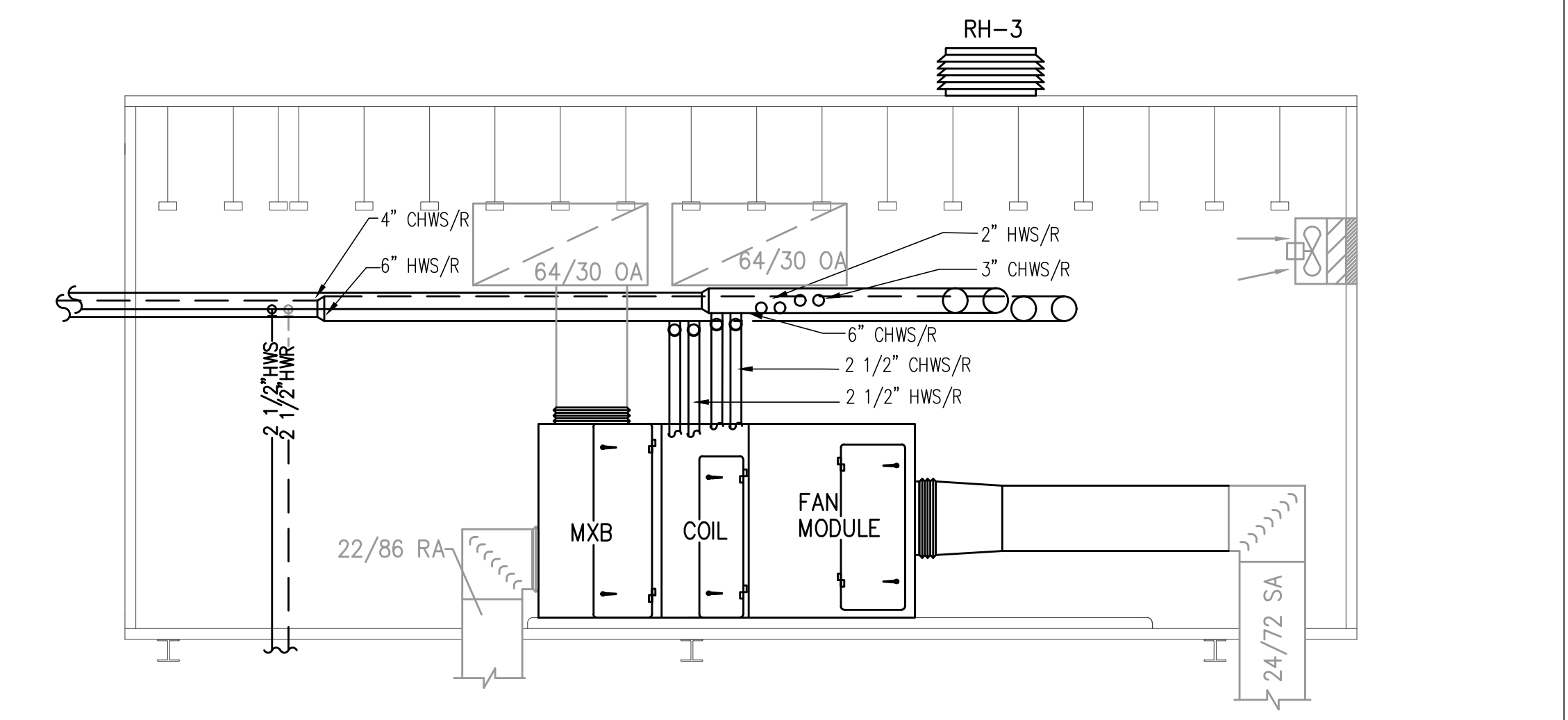
**SECTION A - A**  
 SCALE: 1/4" = 1'-0"  
 12" 0' 1" 5' 10'



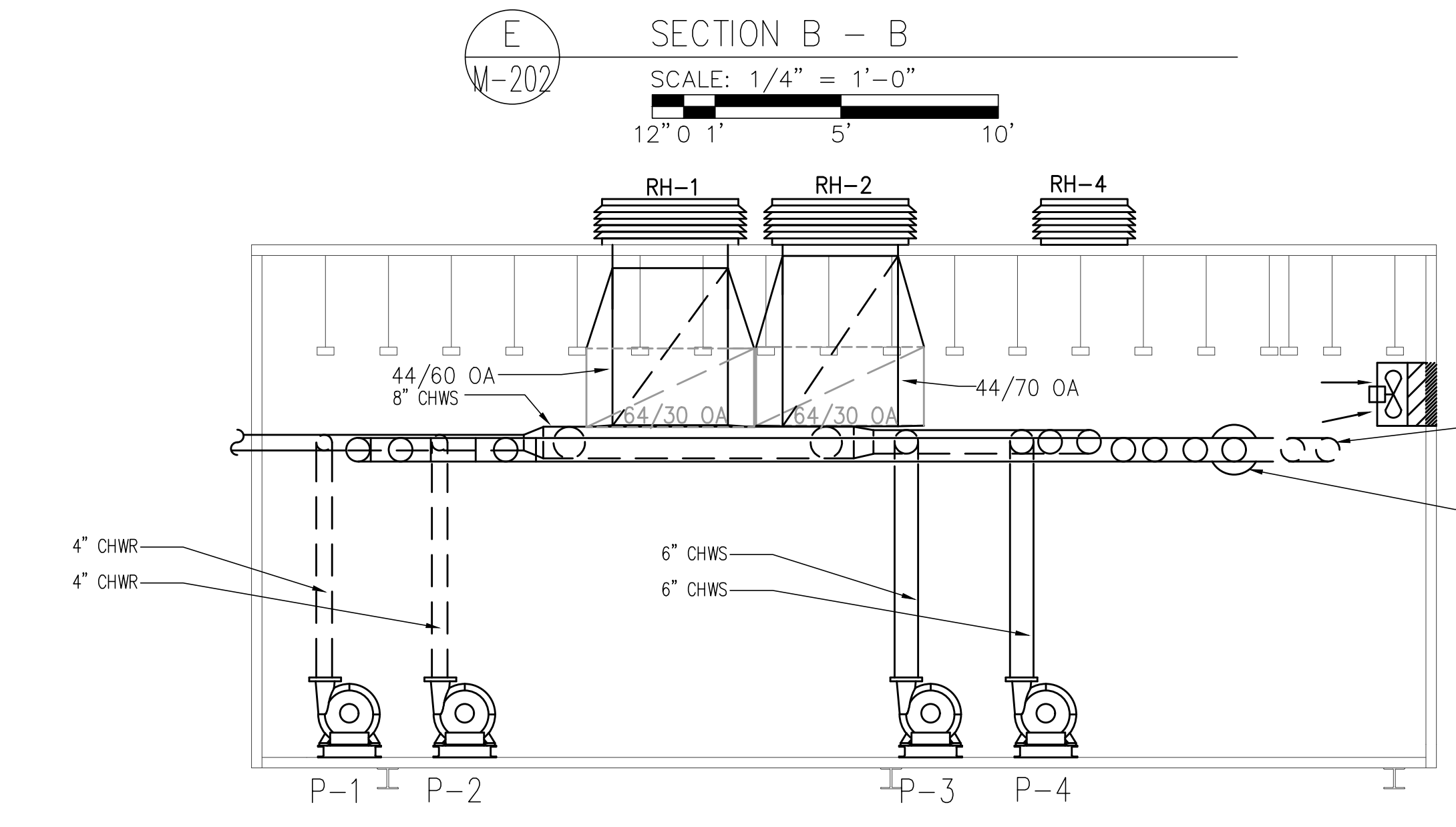
**SECTION C - C**  
 SCALE: 1/4" = 1'-0"  
 12" 0' 1" 5' 10'



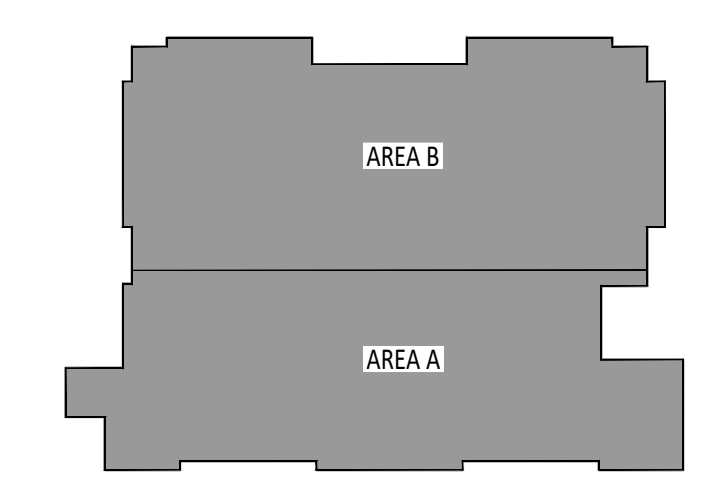
**SECTION B - B**  
 SCALE: 1/4" = 1'-0"  
 12" 0' 1" 5' 10'



**SECTION D - D**  
 SCALE: 1/4" = 1'-0"  
 12" 0' 1" 5' 10'



**SECTION E - E**  
 SCALE: 1/4" = 1'-0"  
 12" 0' 1" 5' 10'



**KEY PLAN**  
 NO SCALE

DATE	NO.	DESCRIPTION

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 Mechanical & Electrical Consulting Engineers  
 1615 South Neil Street, Champaign, Illinois 61820  
 217-356-0536 Business - 217-356-1092 Fax

**PENTHOUSE SECTIONS - HVAC**  
**SATELLITE JAIL HVAC REPLACEMENT**  
 CHAMPAIGN COUNTY  
 502 S LIERMAN AVE URBANA, IL 61802

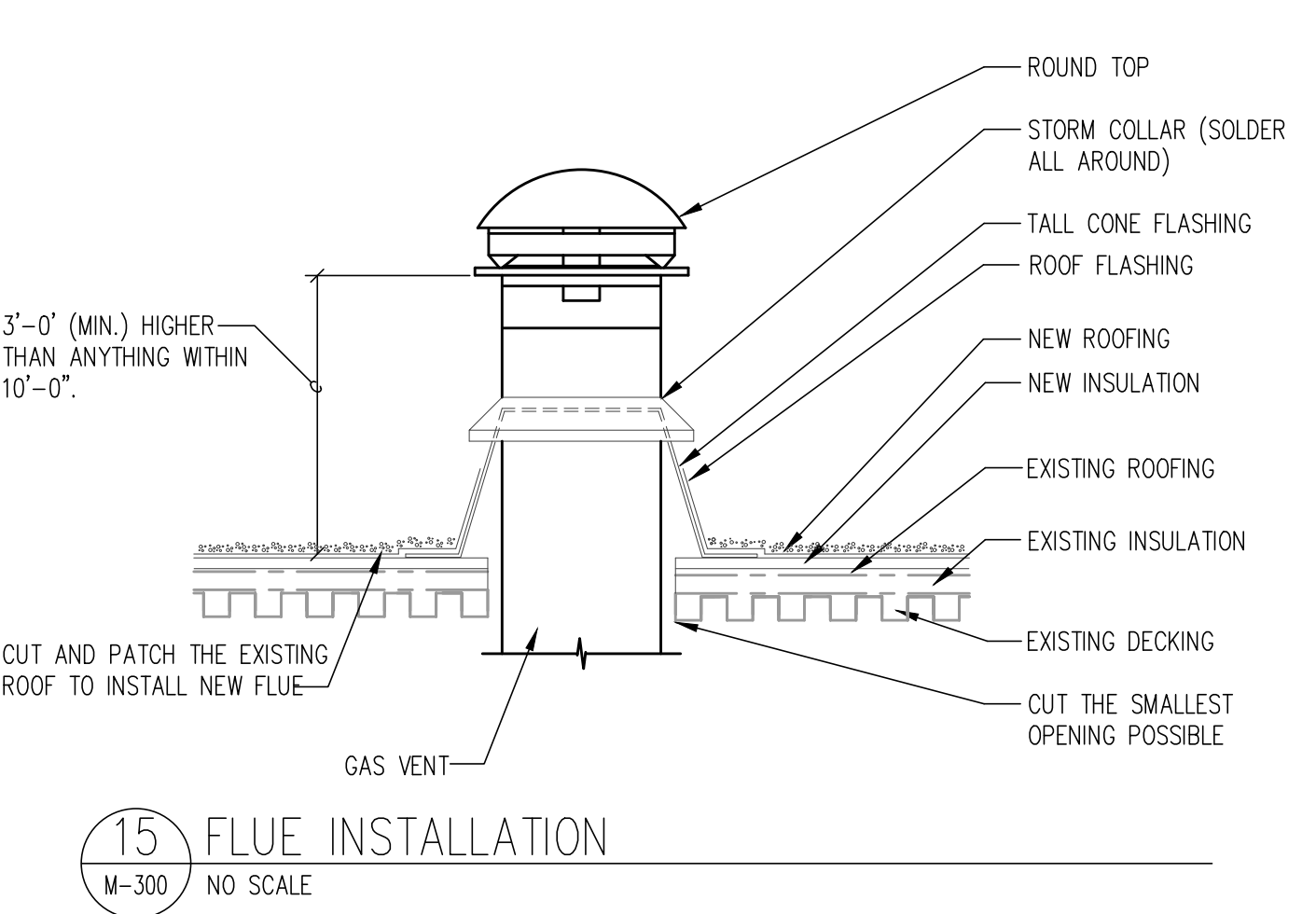
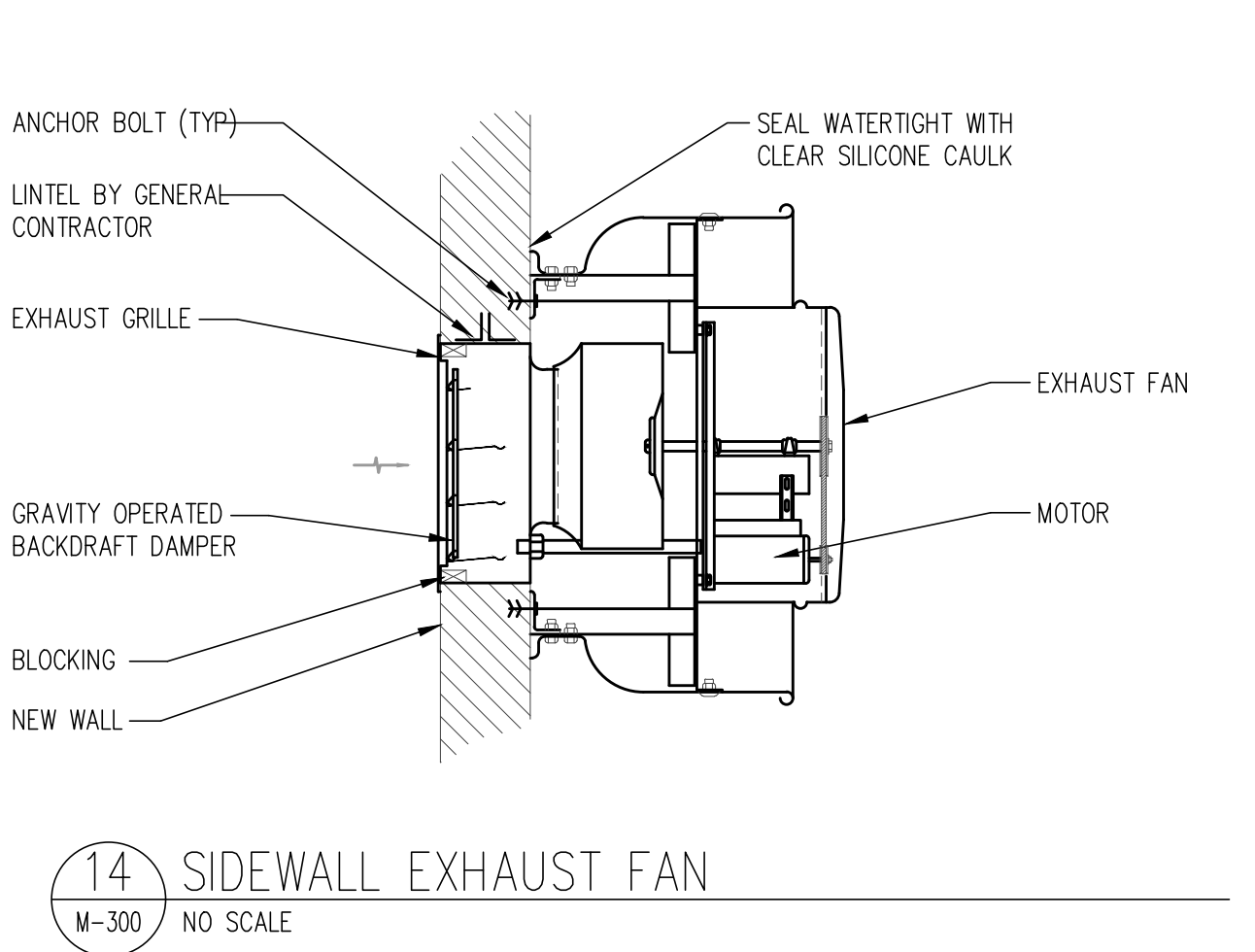
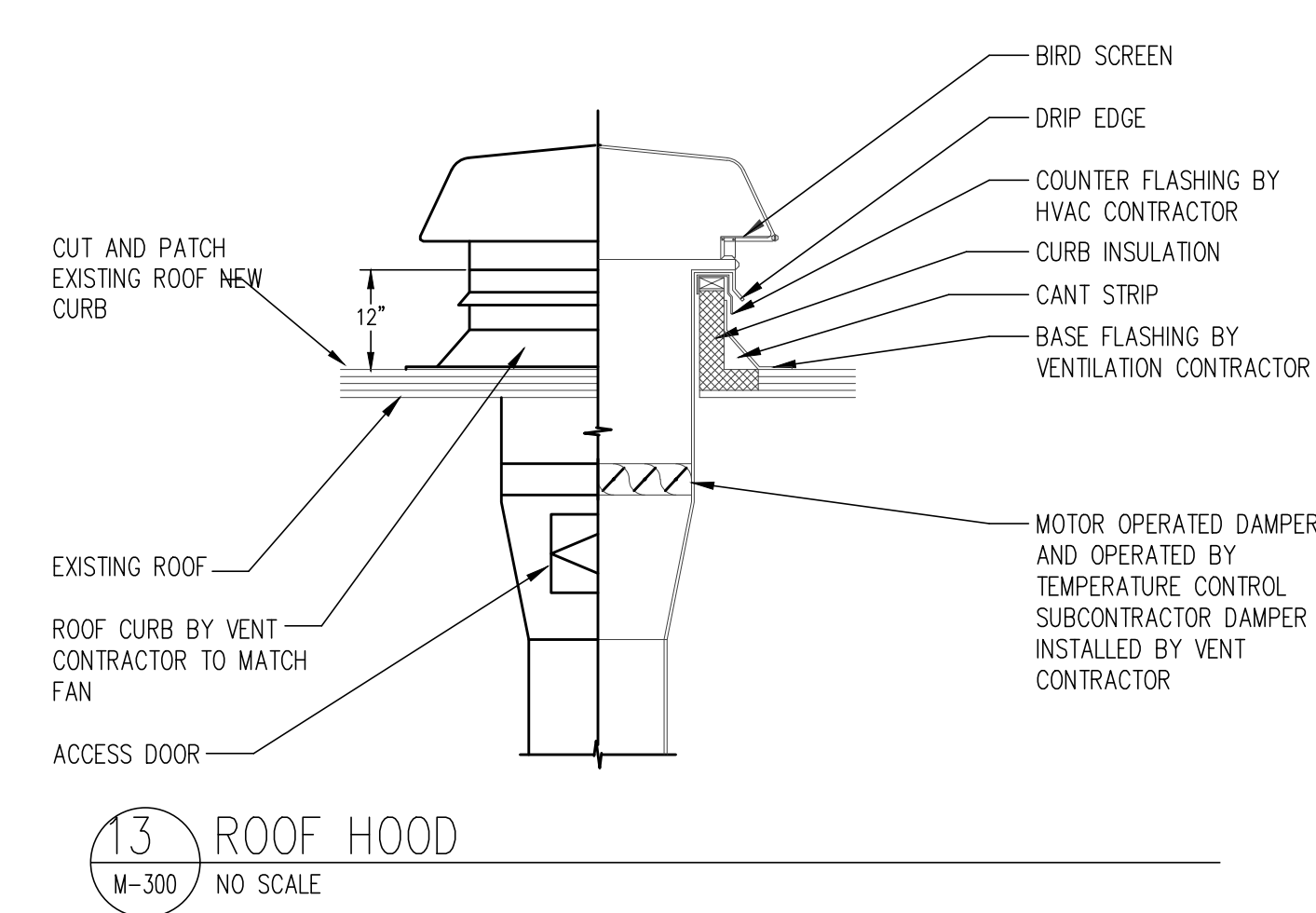
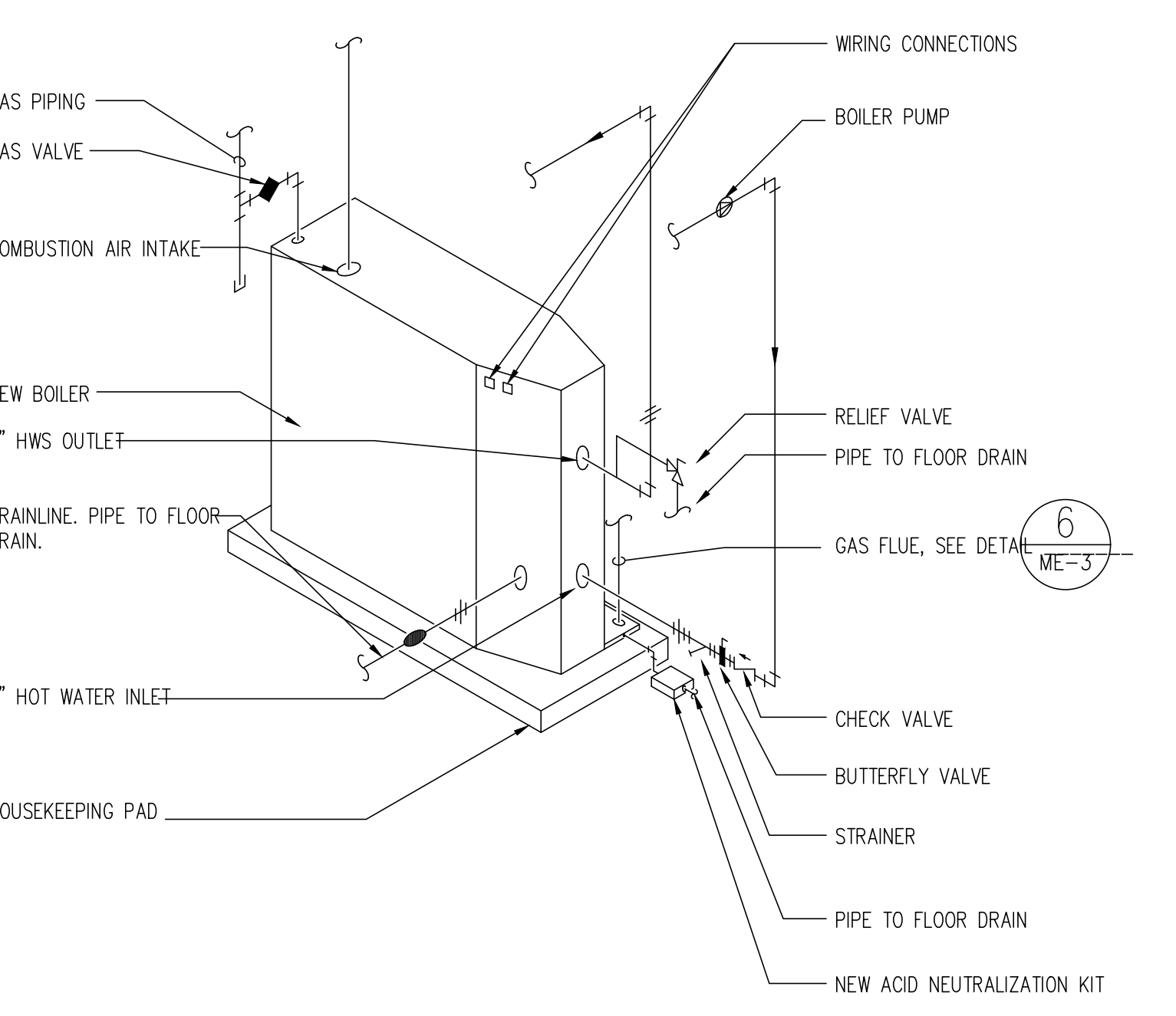
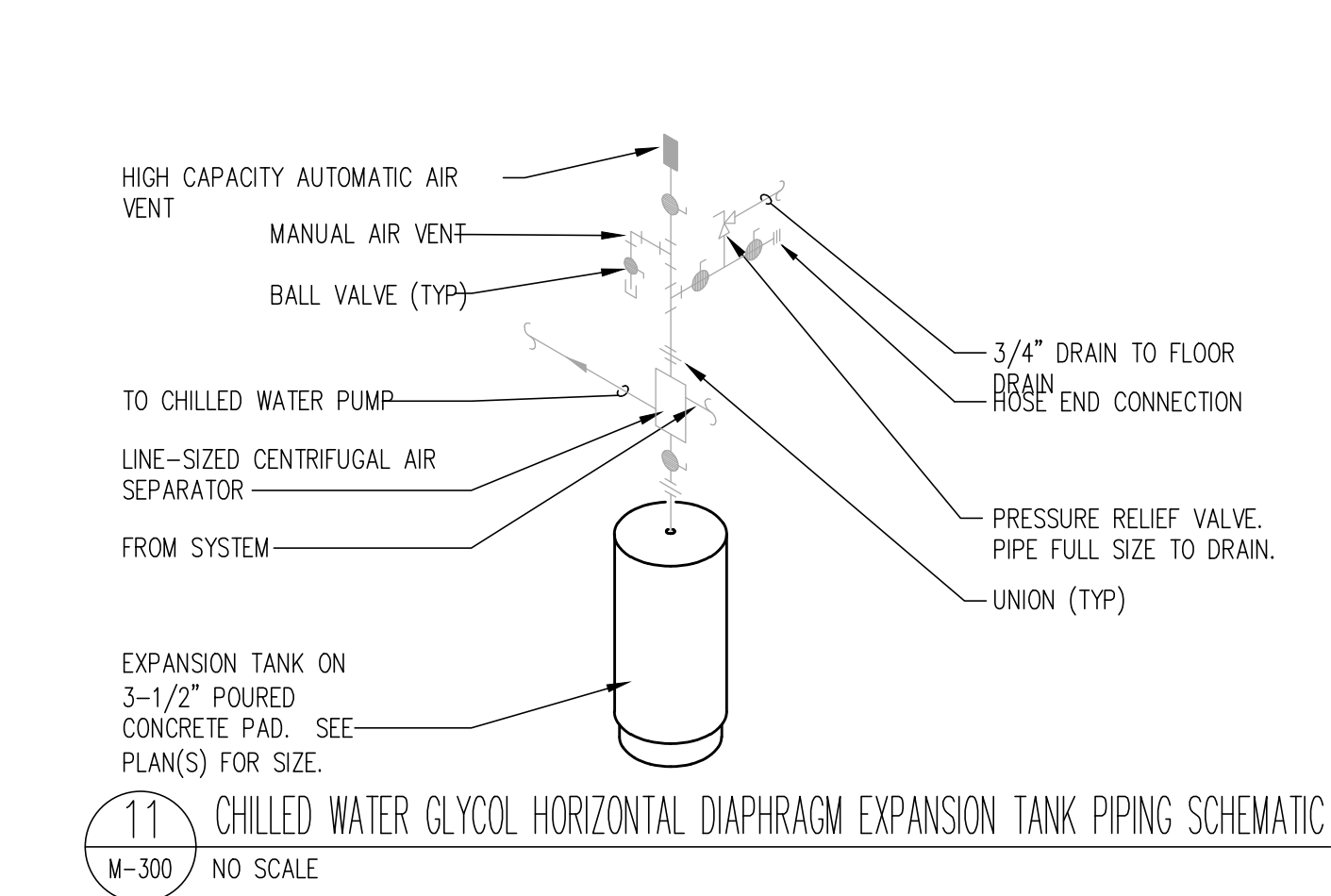
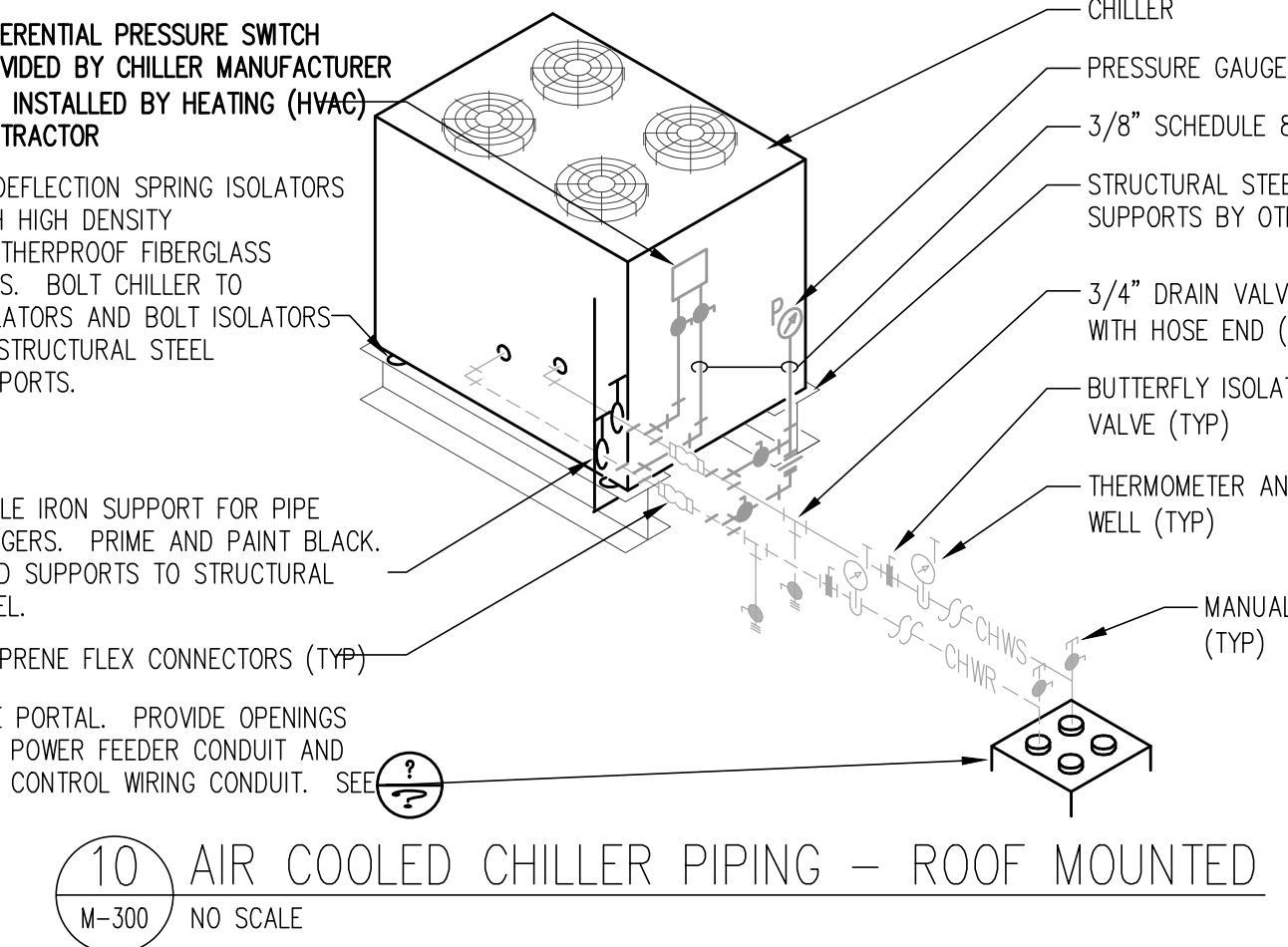
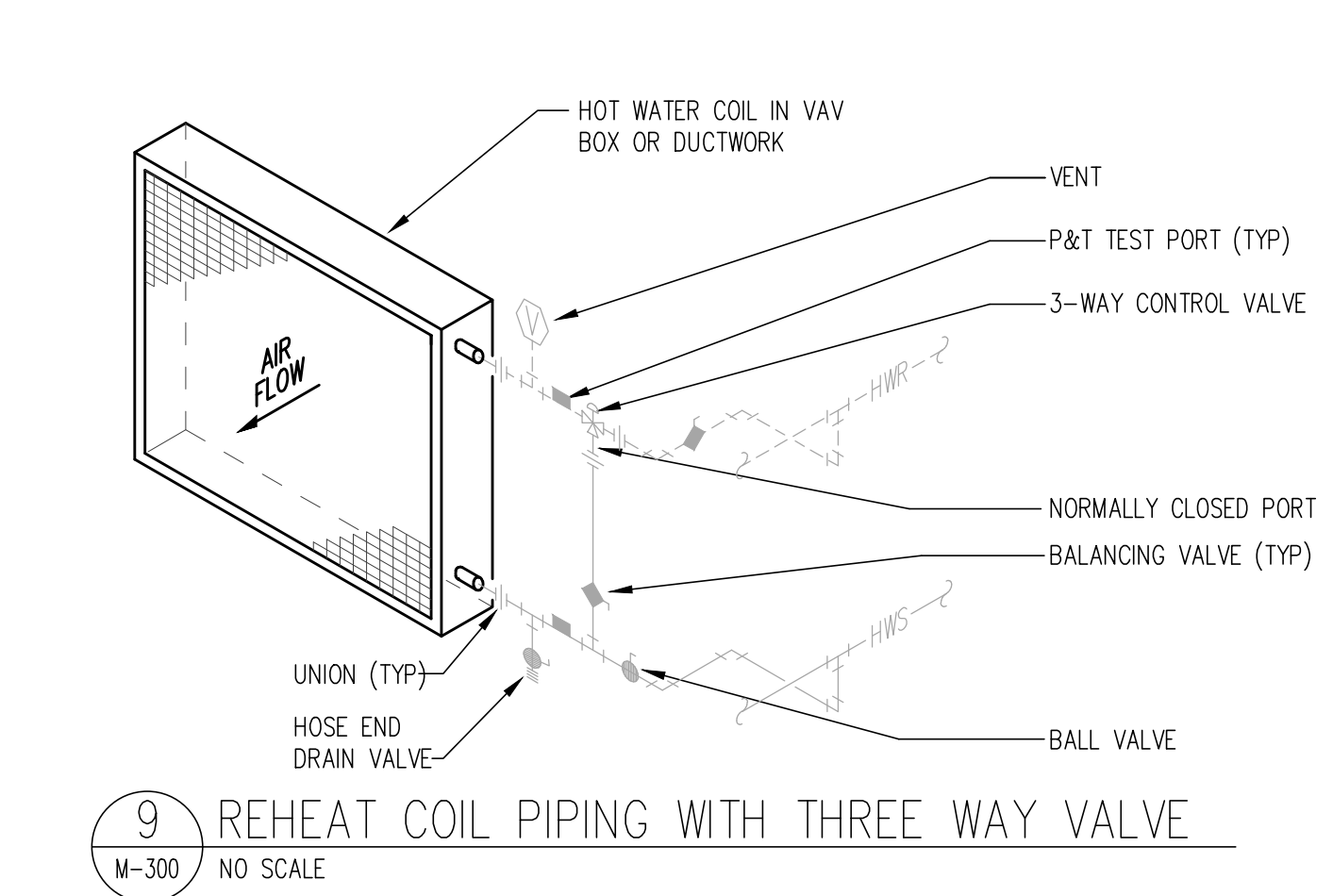
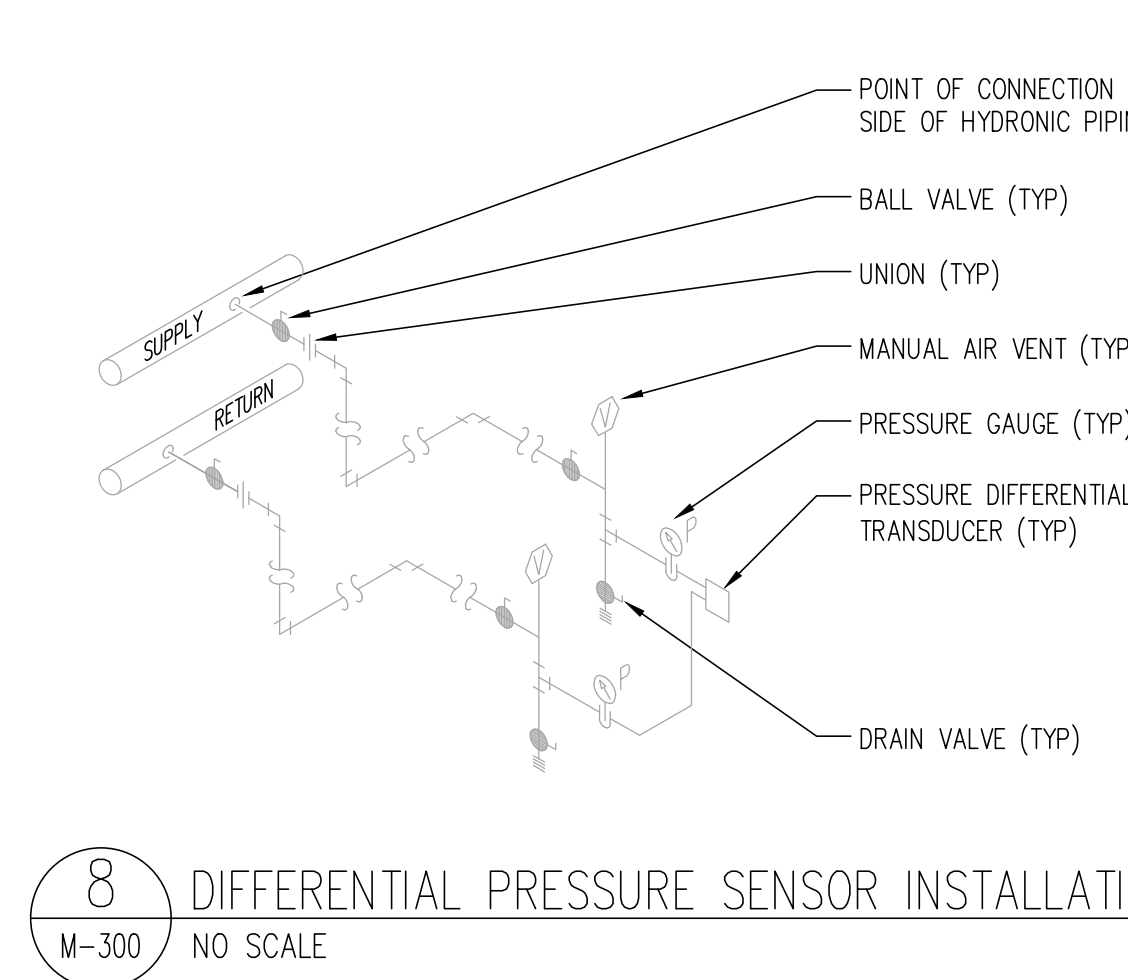
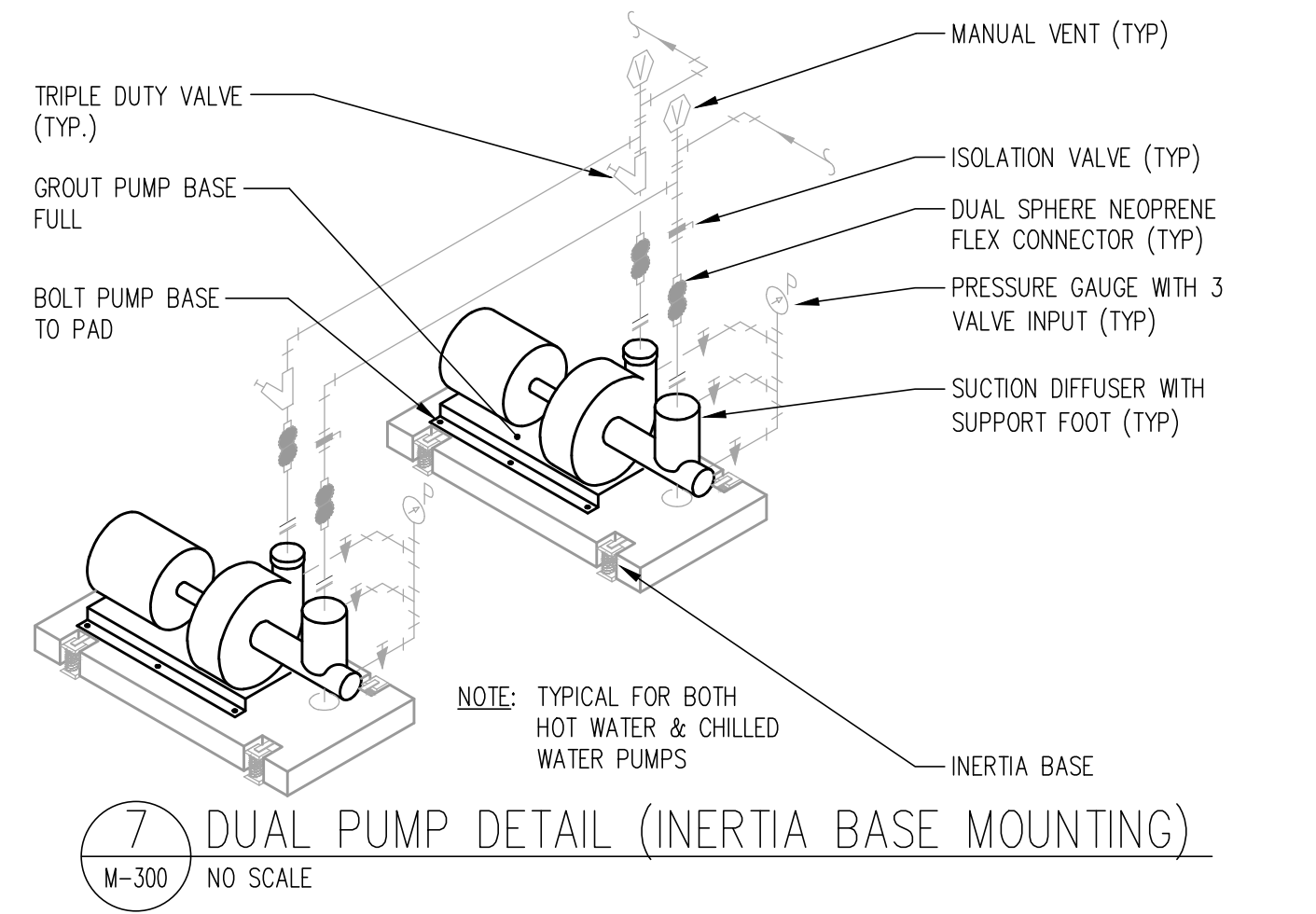
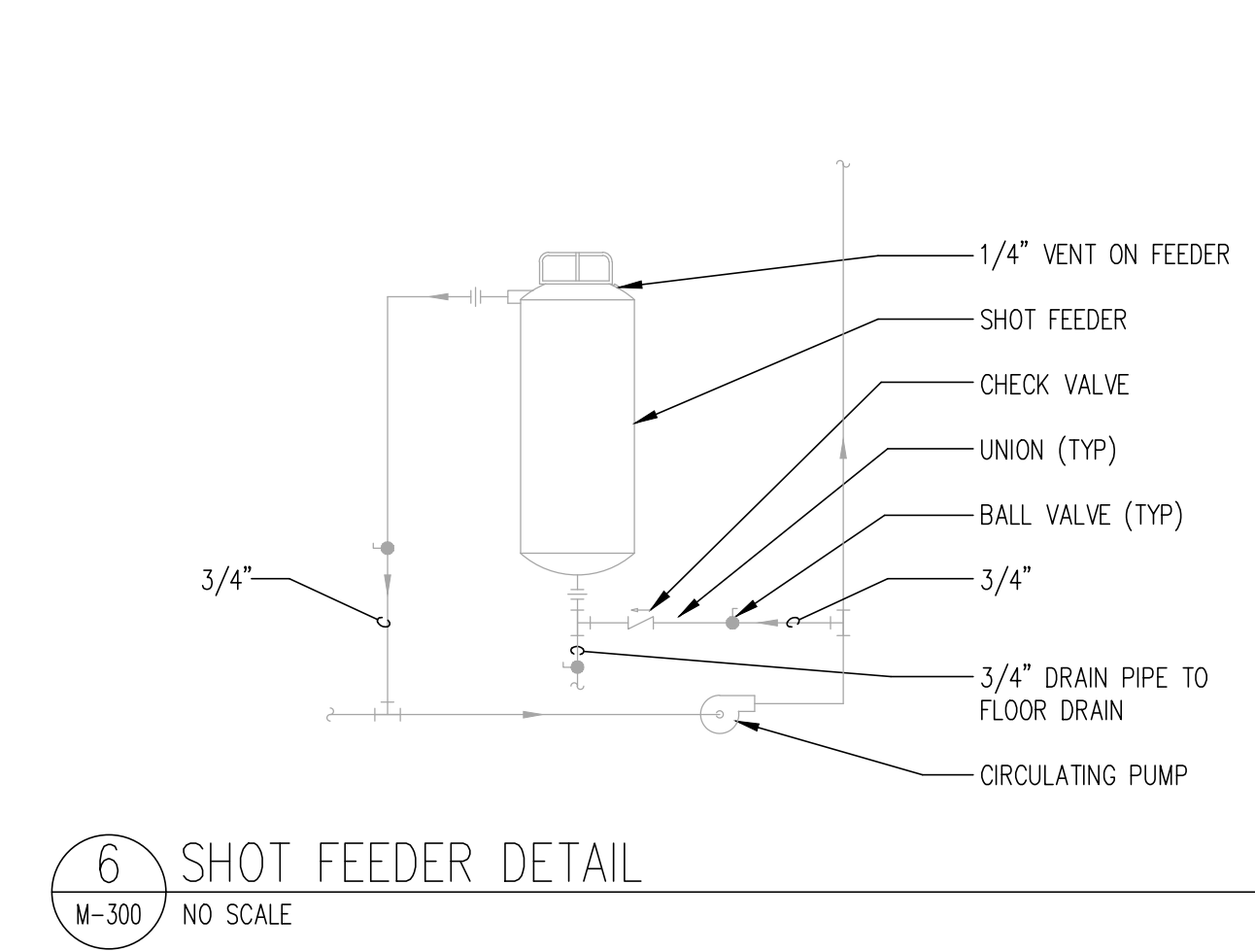
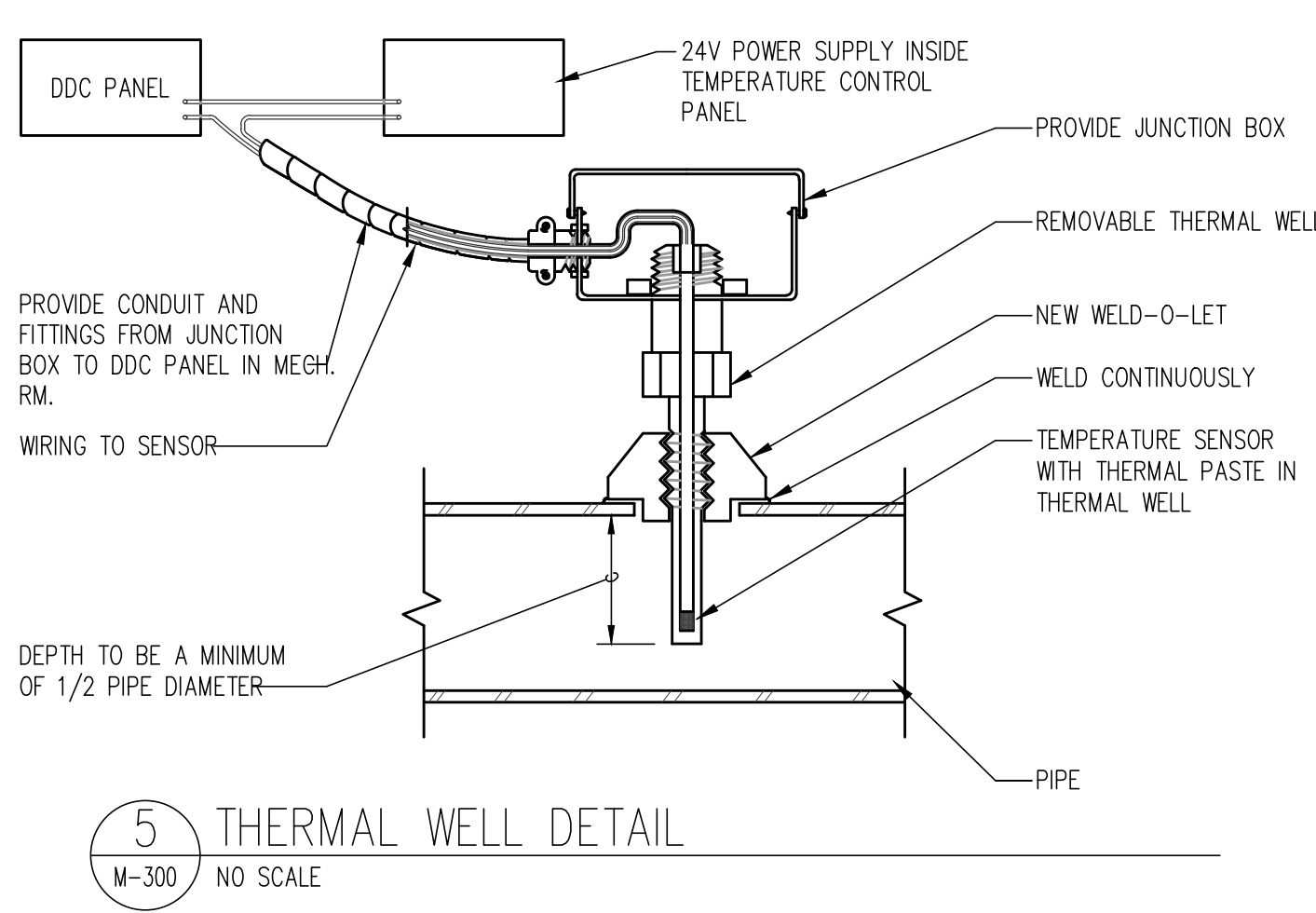
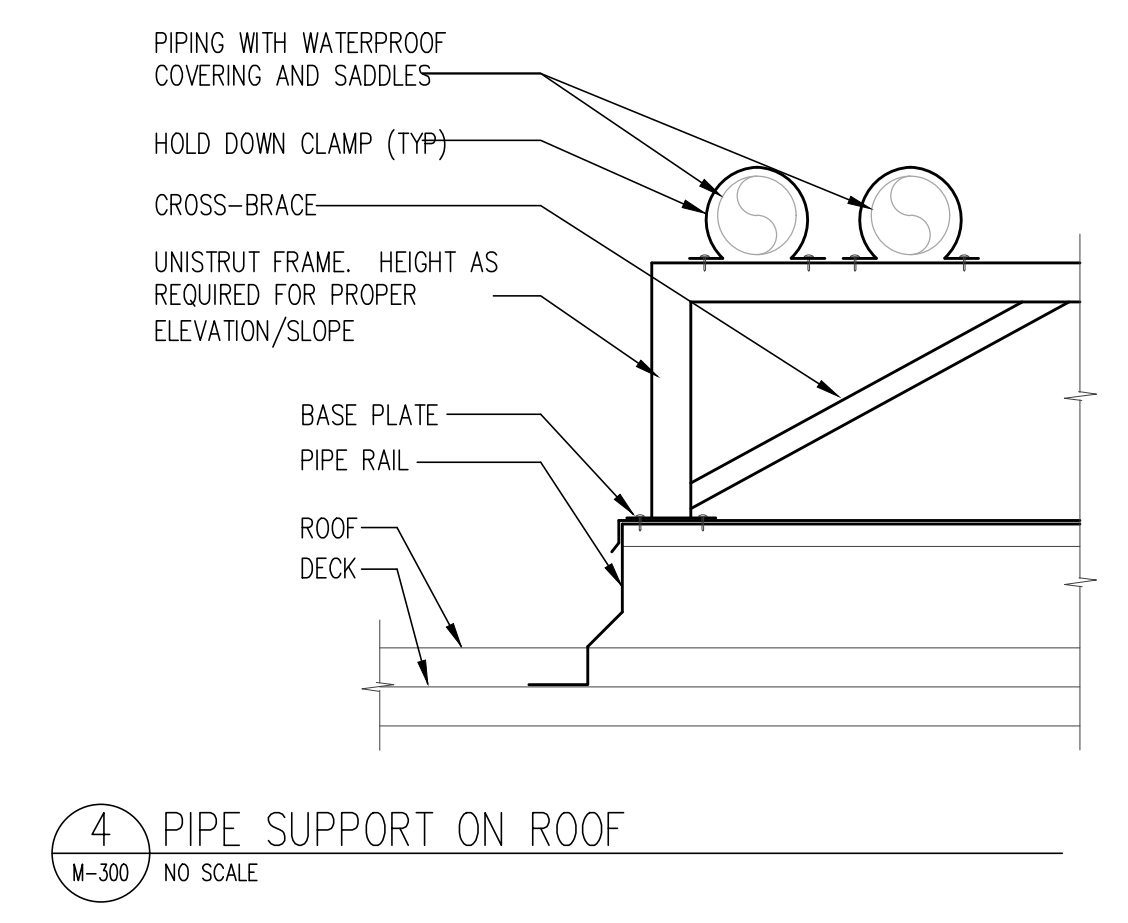
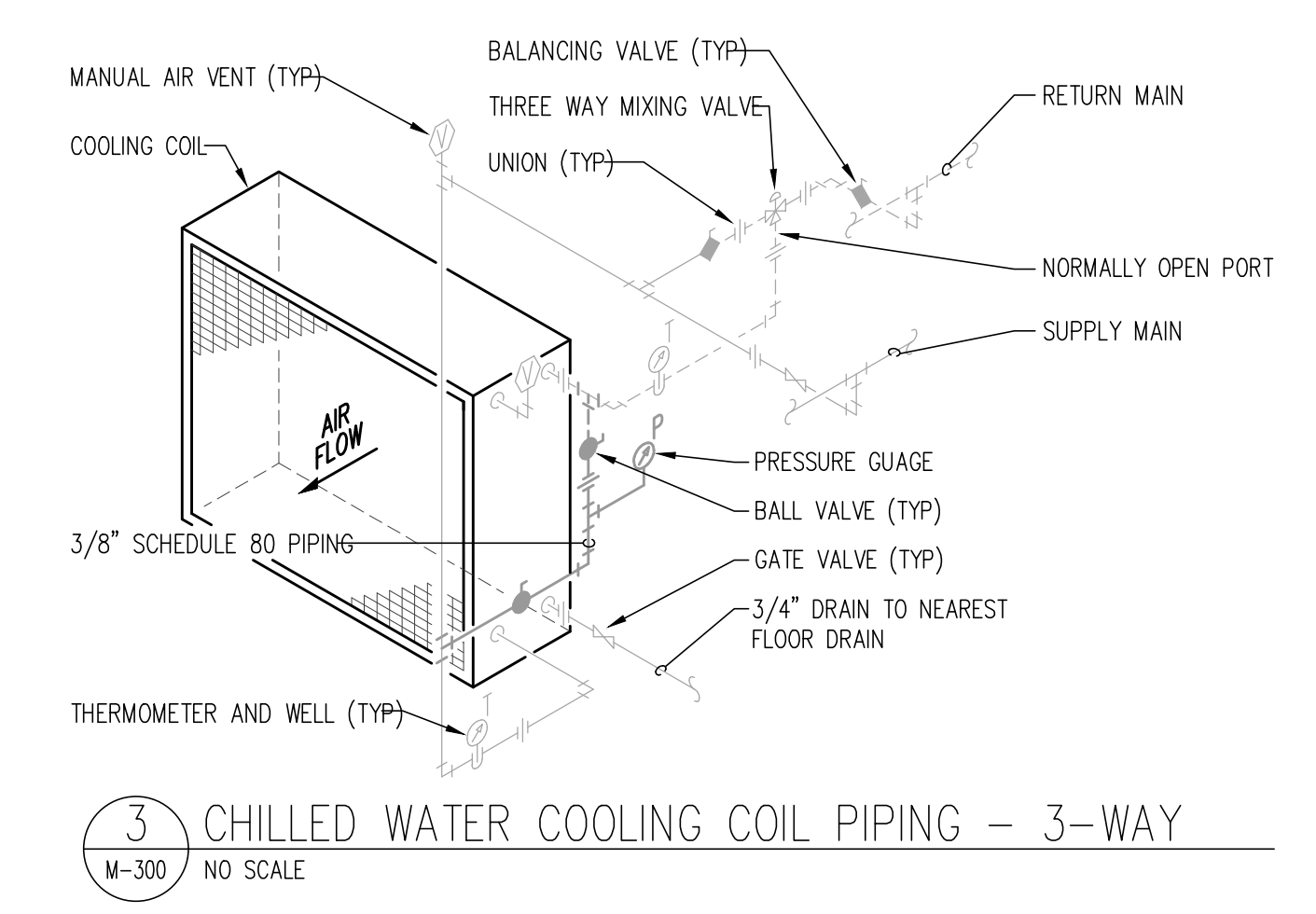
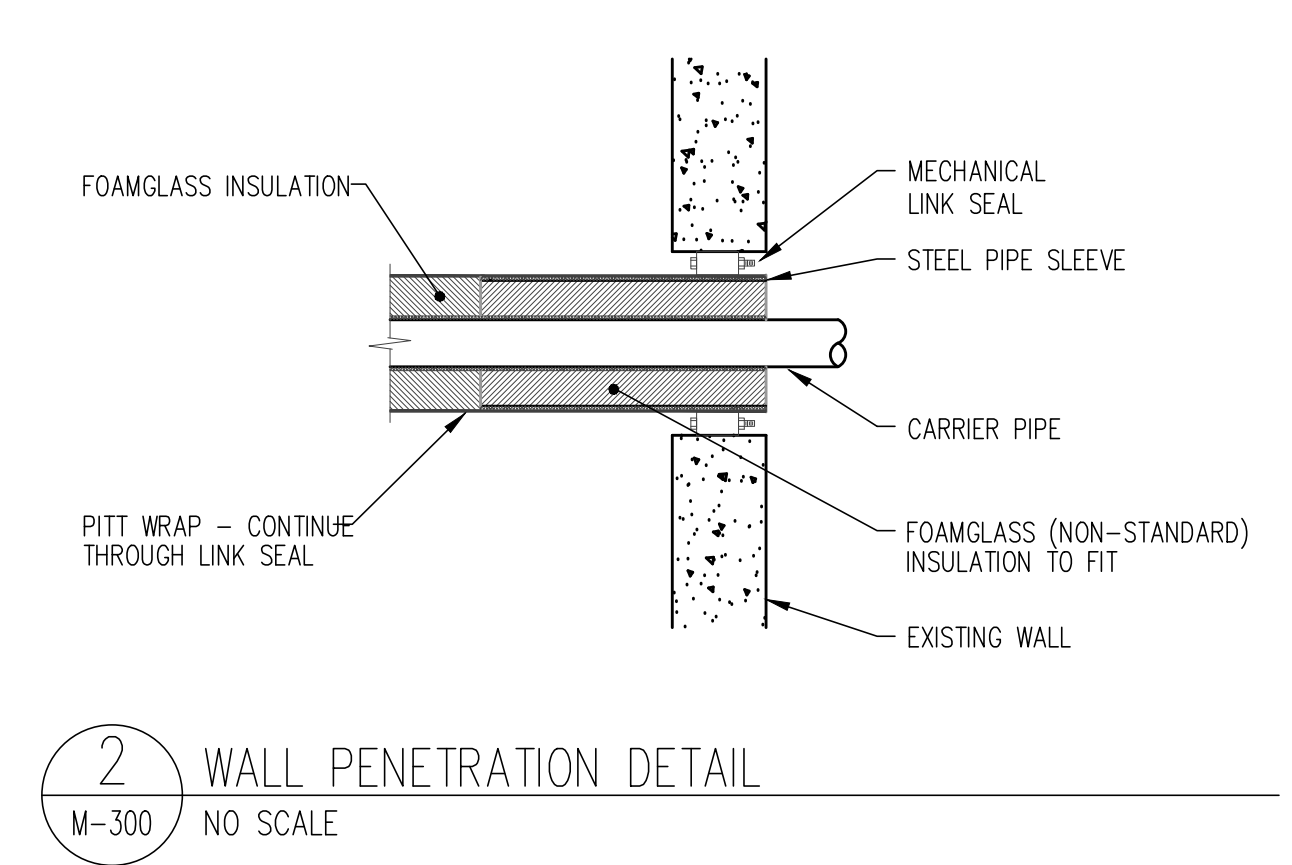
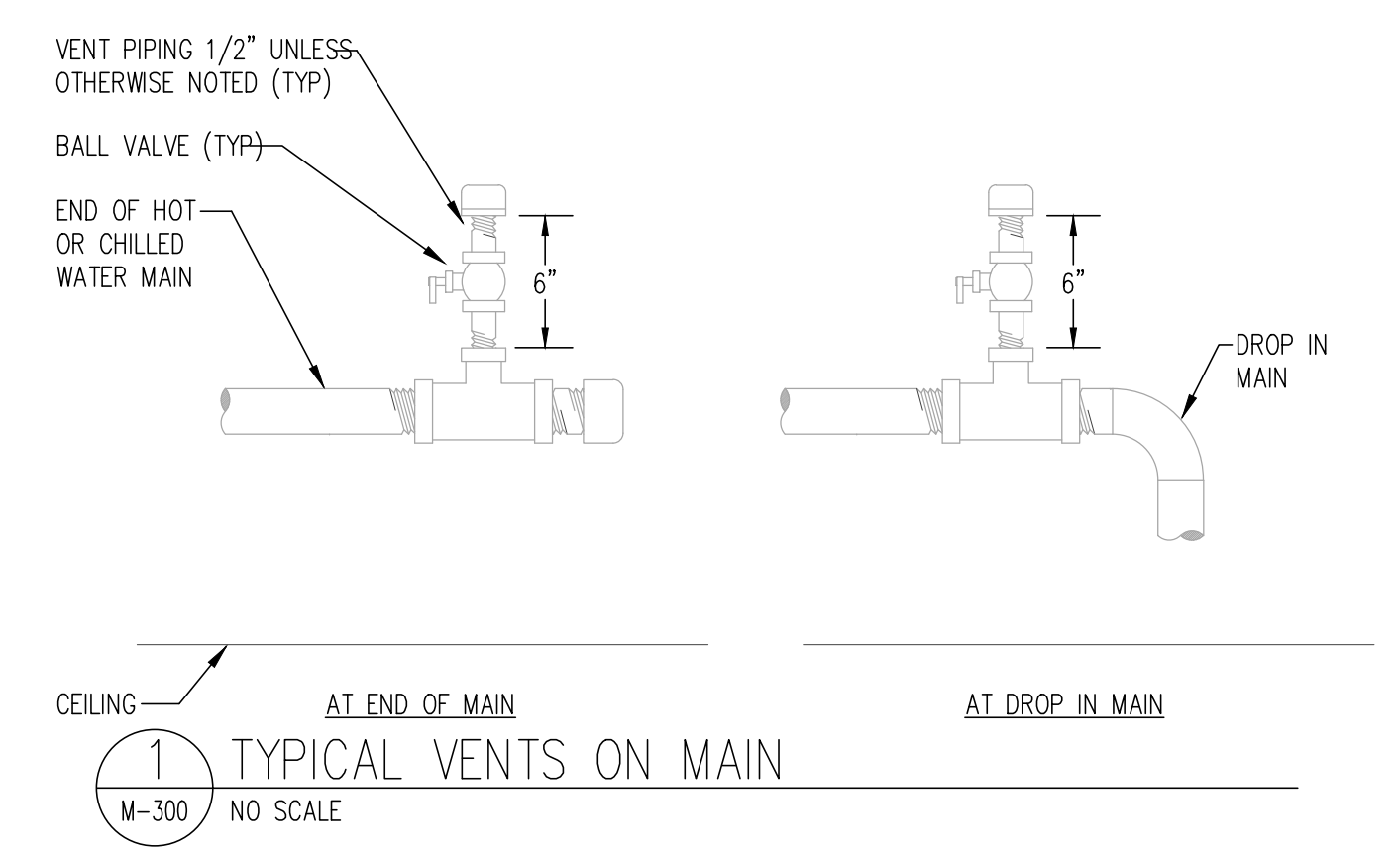
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HEATING SYMBOLS & ABBREVIATIONS	
SYMBOL OR ABBREVIATION	DESCRIPTION
CPD	CONDENSATE PUMP DISCHARGE
CTR	COOLING TOWER RETURN
CTS	COOLING TOWER SUPPLY
CHWR	CHILLED WATER RETURN
CHWS	CHILLED WATER SUPPLY
D	DRAIN LINE
FOR	FUEL OIL RETURN
FOS	FUEL OIL SUPPLY
GWR	GLYCOL WATER RETURN
GWS	GLYCOL WATER SUPPLY
HCWR	HEATING - COOLING WATER RETURN
HCWS	HEATING - COOLING WATER SUPPLY
HPR	HIGH PRESSURE RETURN
HPS	HIGH PRESSURE STEAM (OVER 60 PSI)
HWR	HEATING WATER RETURN
HWS	HEATING WATER SUPPLY
LPR	LOW PRESSURE RETURN
LPS	LOW PRESSURE STEAM (0 TO 15 PSI)
MPR	MEDIUM PRESSURE RETURN
MPS	MEDIUM PRESSURE STEAM (15 TO 60 PSI)
RL	REFRIGERANT LIQUID
RS	REFRIGERANT SUCTION
RHG	REFRIGERANT HOT GAS
GV	GATE VALVE
MCV	MOTOR CONTROL VALVE
TMCV	THREE-WAY MOTOR CONTROL VALVE
PRV	PRESSURE REDUCING VALVE
PRV	PRESSURE RELIEF VALVE
GV	GLOBE VALVE
HEV	HOSE END VALVE
CV	CHECK VALVE
BV	BALANCING VALVE
BFV	BUTTERFLY VALVE
SV	SHUTOFF VALVE
BV	BALL VALVE
VGV	VERTICAL GATE VALVE
STR	STRAINER
UN	UNION
PR	PIPE RISER
PD	PIPE DROP
90E	90° ELL
90W	PIPE DROP WITH 90° ELL
45E	45° ELL
TEE	PIPE TEE
TO	PIPE TAKEOFF (FROM TOP OF MAIN)
TB	PIPE TAKEOFF (FROM BOTTOM OF MAIN)
EC	END CAP
FL	PIPE FLANGE
ER	ECCENTRIC REDUCER
CR	CONCENTRIC REDUCER
FC	FLEXIBLE CONNECTION
EJ	EXPANSION JOINT
SL	PIPE SLEEVE
PG	PIPE GUIDE
PA	PIPE ANCHOR
BK	BREAK
FT	FLOAT AND THERMOSTATIC TRAP
TT	THERMOSTATIC TRAP
NC	NEW CONNECTION TO EXISTING
FS	FLOW SWITCH
EW	EMPTY WELL
TW	THERMOMETER AND WELL
FG	FLUID PRESSURE GAUGE
SPG	STEAM PRESSURE GAUGE
OS	OCCUPANCY SENSOR
RHS	RELATIVE HUMIDITY SENSOR
CDS	CARBON DIOXIDE SENSOR
S	SENSOR
NT	THERMOSTAT
NCT	NIGHT CYCLE CONTROL THERMOSTAT
H	HUMIDISTAT
M	MANUAL AIR VENT



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 Mechanical & Electrical Consulting Engineers  
 1615 South Neil Street, Champaign, Illinois 61820  
 217-356-0536 Business • 217-356-1092 Fax

**DETAILS - HVAC**  
**SATELLITE JAIL HVAC REPLACEMENT**  
 CHAMPAIGN COUNTY  
 502 S LIERMAN AVE URBANA, IL 61802

DATE: APRIL 23, 2021  
 PROJECT: GHR # 7253  
 DRAWN: JMD  
 APPROVED: RCVN  
 SHEET: M-300  
 95% CD

**VENTILATING SYMBOLS & ABBREVIATIONS**

SYMBOL OR ABBREVIATION	DESCRIPTION
AHU	AIR HANDLING UNIT
EAD	EXHAUST AIR DAMPER
---	1 HR FIRE RATED WALL
----	1 HR SMOKE AND FIRE RATED WALL
-----	2 HR FIRE RATED WALL
-----	2 HR SMOKE AND FIRE RATED WALL
EF	EXHAUST FAN
EG	EXHAUST GRILLE
EXH	EXHAUST
FC	FAN COIL UNIT
FOB	FLAT ON BOTTOM
FOT	FLAT ON TOP
OA	OUTDOOR AIR
OAD	OUTSIDE AIR DAMPER
RA	RETURN AIR
RAD	RETURN AIR DAMPER
RF	RETURN FAN
RG	RETURN GRILLE
RH	ROOF HOOD
SA	SUPPLY AIR
SD	SUPPLY DIFFUSER
TG	TRANSFER GRILLE
UV	UNIT VENTILATOR
VD	VOLUME DAMPER
☒	SUPPLY DUCT
☑	RETURN DUCT
☑	SUPPLY DIFFUSER (WITH HARD DUCT)
☑	SUPPLY DIFFUSER (WITH FLEXDUCT)
☑	SUPPLY DIFFUSER (TWO WAY)
☑	RETURN GRILLE
☑	SIDEWALL RETURN GRILLE
☑	FIRE DAMPER
☑	FIRE AND SMOKE DAMPER
☑	SMOKE DAMPER
☑	VOLUME DAMPER
☑	OFFSET (DOUBLE 45° RADIUS FITTINGS)
☑	FLEXIBLE DUCT CONNECTION
☑	TRANSITION FROM SQUARE TO ROUND DUCT
☑	SQUARE ELL WITH TURNING VANES
☑	SPLITTER DAMPER
☑	200% CONNECTION WITH VOLUME DAMPER AND FLEX DUCT
☑	TAKE OFF
☑	AD ACCESS DOOR

MARK	LOCATION	MANUFACTURER	CATALOG NUMBER	FLUID	EVAPORATOR				ELECTRICAL DATA			REMARKS	
					EWT °F	LWT °F	GPM	WPD	MAX FUSE AMPS	VOLTS	PHASE		CYCLE
CH-1	ROOF	CARRIER	30RBX19064-LHL3C	FRESH WATER	54	44	444.8	12.1	408	460	3	60	
CH-2	ROOF	CARRIER	30RBX19064-LHL3C	FRESH WATER	54	44	444.8	12.1	408	460	3	60	

MARK	LOCATION	MANUFACTURER	MODEL NUMBER	AGA INPUT MBH	AGA OUTPUT MBH	FUEL	ELECTRICAL	REMARKS
B-1,2,3	PENTHOUSE	LOCHINVAR	FBN2001	1999	1923	NAT GAS	480V/3PH/60Hz	

MARK	MANUFACTURER	MODEL	LOCATION	SYST	FLUID	Fluid Temp	GPM	SIZE, in.		HEAD, ft. WC		MOTOR		REMARKS	
								Disch	Suct	Oper	Cutoff	HP	RPM		Volts / Phase
P-1	BELL & GOSSET	1510	PENTHOUSE	CH-1	WATER	45	444.8	3	4	45.5	48.2	7.5	1720	480/3	TEMPERATURE CONTROL CONTRACTOR TO PROVIDE VFD. PROVIDE WITH INVERTER-DUTY RATED MOTOR.
P-2	BELL & GOSSET	1510	PENTHOUSE	CH-2	WATER	45	444.8	3	4	45.5	48.2	7.5	1720	480/3	TEMPERATURE CONTROL CONTRACTOR TO PROVIDE VFD. PROVIDE WITH INVERTER-DUTY RATED MOTOR.
P-3	BELL & GOSSET	1510	PENTHOUSE	CHW	WATER	45	570.9	3	4	73	74.6	15	1732	480/3	TEMPERATURE CONTROL CONTRACTOR TO PROVIDE VFD. PROVIDE WITH INVERTER-DUTY RATED MOTOR.
P-4	BELL & GOSSET	1510	PENTHOUSE	CHW	WATER	45	570.9	3	4	73	74.6	15	1732	480/3	TEMPERATURE CONTROL CONTRACTOR TO PROVIDE VFD. PROVIDE WITH INVERTER-DUTY RATED MOTOR.
P-5	BELL & GOSSET	1510	PENTHOUSE	HW	WATER	180	421.8	3	4	45.5	48.2	10	1759	480/3	TEMPERATURE CONTROL CONTRACTOR TO PROVIDE VFD. PROVIDE WITH INVERTER-DUTY RATED MOTOR.
P-6	BELL & GOSSET	1510	PENTHOUSE	HW	WATER	180	421.8	3	4	65.9	66.8	10	1759	480/3	TEMPERATURE CONTROL CONTRACTOR TO PROVIDE VFD. PROVIDE WITH INVERTER-DUTY RATED MOTOR.

MARK	MANUFACTURER	MODEL	AIR FLOW PATTERN	CFM	GPM	WPD (FEET)	CAPACITY BTU/HR	MOTOR		MOUNTING HEIGHT	REMARKS
								H.P.	Volts / Phase		
GWH-7	REZNOR	UB2300	CENTRIFUGAL	5123	-	-	300,000	1.5	115/1	UB2300	

ENTERING WATER TEMPERATURE -
LEAVING WATER TEMPERATURE -
ENTER AIR TEMPERATURE -

MARK	MANUFACTURER	MODEL	LOCATION	CAPACITY (BTU)	VOLTS / PHASE	COMPRESSOR(S)			CONDENSER FAN(S)			SEER (EER)	REMARKS
						Number	RLA	K.W.	Number	H.P.	Phase		
ACCU	DATA AIRE	DRCU	ROOF										

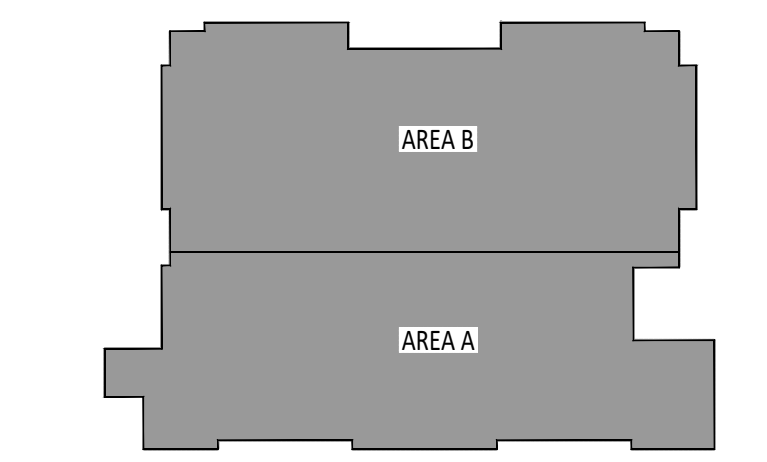
MARK	MANUFACTURER	MODEL	STYLE	TYPE	MIN CFM	MAX CFM	THROAT AREA (SQ FT)	THROAT SIZE	CURB CAP	PD	REMARKS
RH-1	GREENHECK	WH	-	-	14500	14500	18.33	44"x70"	52"x68"	0.114	
RH-2	GREENHECK	WH	-	-	17000	17000	21.39	44"x60"	52"x78"	0.113	
RH-3	GREENHECK	WH	-	-	3000	3000	4.17	25"x24"	33"x32"	0.094	
RH-4	GREENHECK	WH	-	-	3000	3000	4.17	25"x24"	33"x32"	0.094	



MARK	LOCATION	MANUFACTURER	MODEL NUMBER AND DRIVE	CFM	STATIC PRESSURE	RPM	MOTOR			REMARKS
							H.P.	VOLTS	PHASE	
EF-20	PENTHOUSE	GREENHECK	CUBE WALL - BELT	3000	0.25	1726	1	460	3	

**AIR HANDLING UNIT SCHEDULE**

MARK	AHU-1	AHU-2,3	AHU-4
SERVING	CELLS	CELLS	CELLS
LOCATION	NORTH PENTHOUSE	NORTH, SOUTH PENTHOUSE	SOUTH PENTHOUSE
UNIT TYPE	HORIZONTAL VAV	HORIZONTAL VAV	HORIZONTAL VAV
ARRANGEMENT	DRAW THRU	DRAW THRU	DRAW THRU
MANUFACTURER	CARRIER	CARRIER	CARRIER
MODEL NUMBER			
CFM (STANDARD AIR)	9310	17200	14500
EXTERNAL STATIC PRESSURE (INCHES W.C.)	2.50	2.75	3.0
TOTAL STATIC PRESSURE (INCHES W.C.)	4.39	4.54	4.88
OUTLET VELOCITY (FPM)	434.2	469	477.8
RPM	1200	1200	1200
MOTOR HORSEPOWER / VOLTAGE / PHASE	10/460/3	20/460/3	10/460/3
MINIMUM OUTDOOR AIR (CFM)	-	-	-
HEATING MEDIA	HOT WATER	HOT WATER	HOT WATER
FACE AREA (SQ. FT.)	21.44	36.67	30.35
(#COILS) HEIGHT / LENGTH	(1)	(1)	(1)
TUBE DIAMETER	0.5	0.5	0.5
ROWS / TYPE / F.P.F.	-	-	-
ENTERING AIR TEMPERATURE (°F db)	10	60	60
LEAVING AIR TEMPERATURE (°F db)	84.78	90.8	90.51
AIR SIDE PRESSURE DROP (INCHES W.C.)	-	-	-
TOTAL HEATING CAPACITY (MBH)	845.95	589.16	492.07
HEATING MEDIA FLOW RATE ( )	86.5	60.3	50.3
HEATING MEDIA ENTERING TEMPERATURE OR PRESSURE	180	180	180
HEATING MEDIA LEAVING TEMPERATURE	160	160	160
HEATING MEDIA PRESSURE DROP (FT. WATER)	23.4	7.8	7.0
COOLING MEDIA	R-410A	R-410A	R-410A
FACE AREA (SQ. FT.)	21.44	36.67	30.35
(#COILS) HEIGHT / LENGTH	(1)	(1)	(1)
TUBE DIAMETER	0.5	0.5	0.5
ROWS / TYPE / F.P.F.	-	-	-
ENTERING AIR °F db / °wF	74.60	67	67
LEAVING AIR °F db / °wF	49.45	51.65	51.85
AIR SIDE PRESSURE DROP (INCHES W.C.)	-	-	-
TOTAL COOLING CAPACITY (MBH)	705.78	761.64	635.02
COOLING MEDIA FLOW RATE ( )	140.7	151.8	126.6
COOLING MEDIA ENTERING / LEAVING TEMP.	45/55	45/55	45/55
COOLING MEDIA PRESSURE DROP (FT. WATER)	10.9	7.6	6.5



**KEY PLAN**  
NO SCALE

FILE: H:\GHR Projects\7253 - Champaign County Satellite Jail - Mechanical Upgrade\HVAC\01 - Worksheets\7253 - M-400.dwg  
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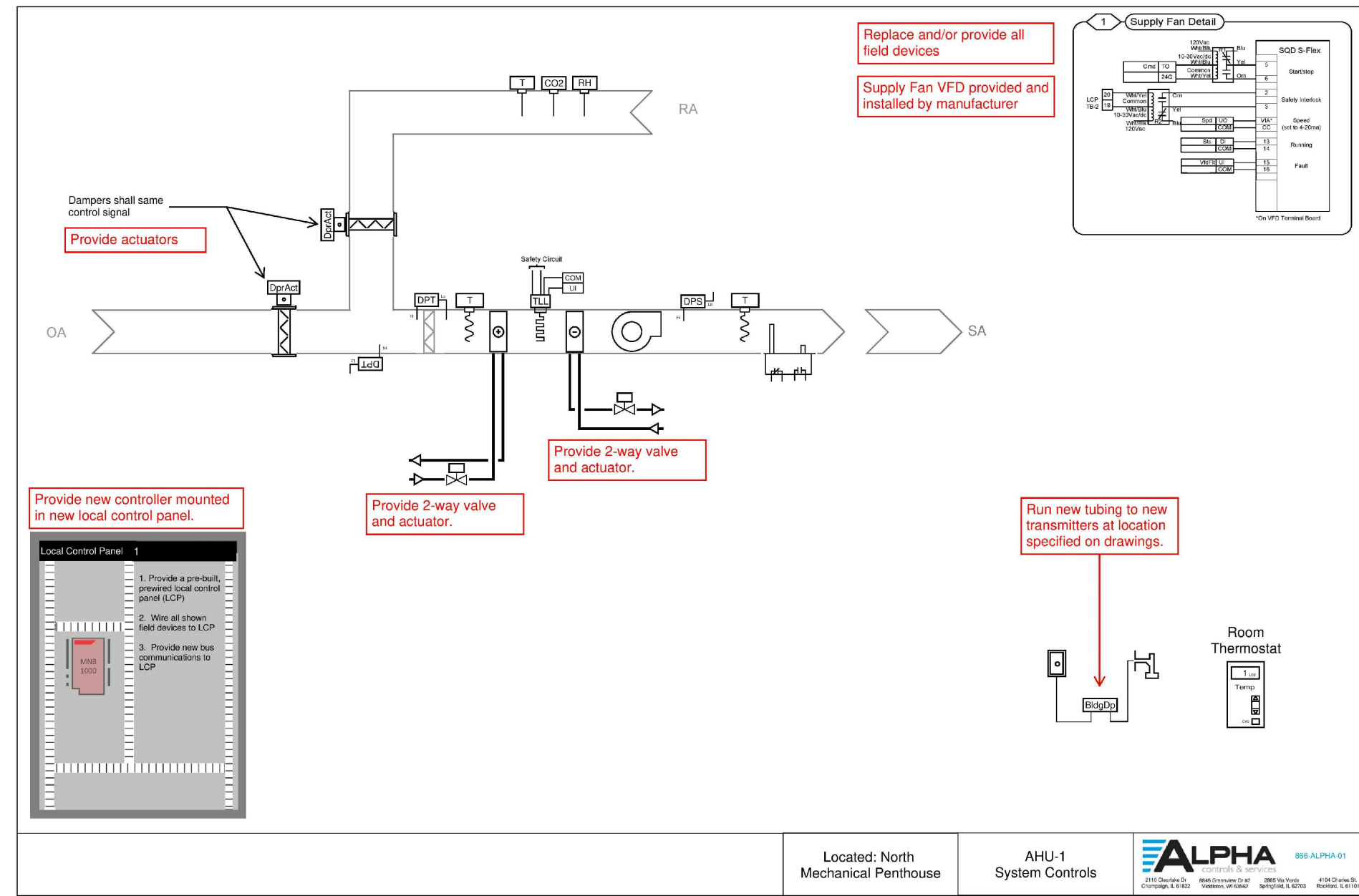
DATE	NO.	DESCRIPTION

**GHR ENGINEERS AND ASSOCIATES, INC.**  
Mechanical & Electrical Consulting Engineers  
1615 South Neil Street, Champaign, Illinois 61820  
217-356-0536 Business - 217-356-1092 Fax

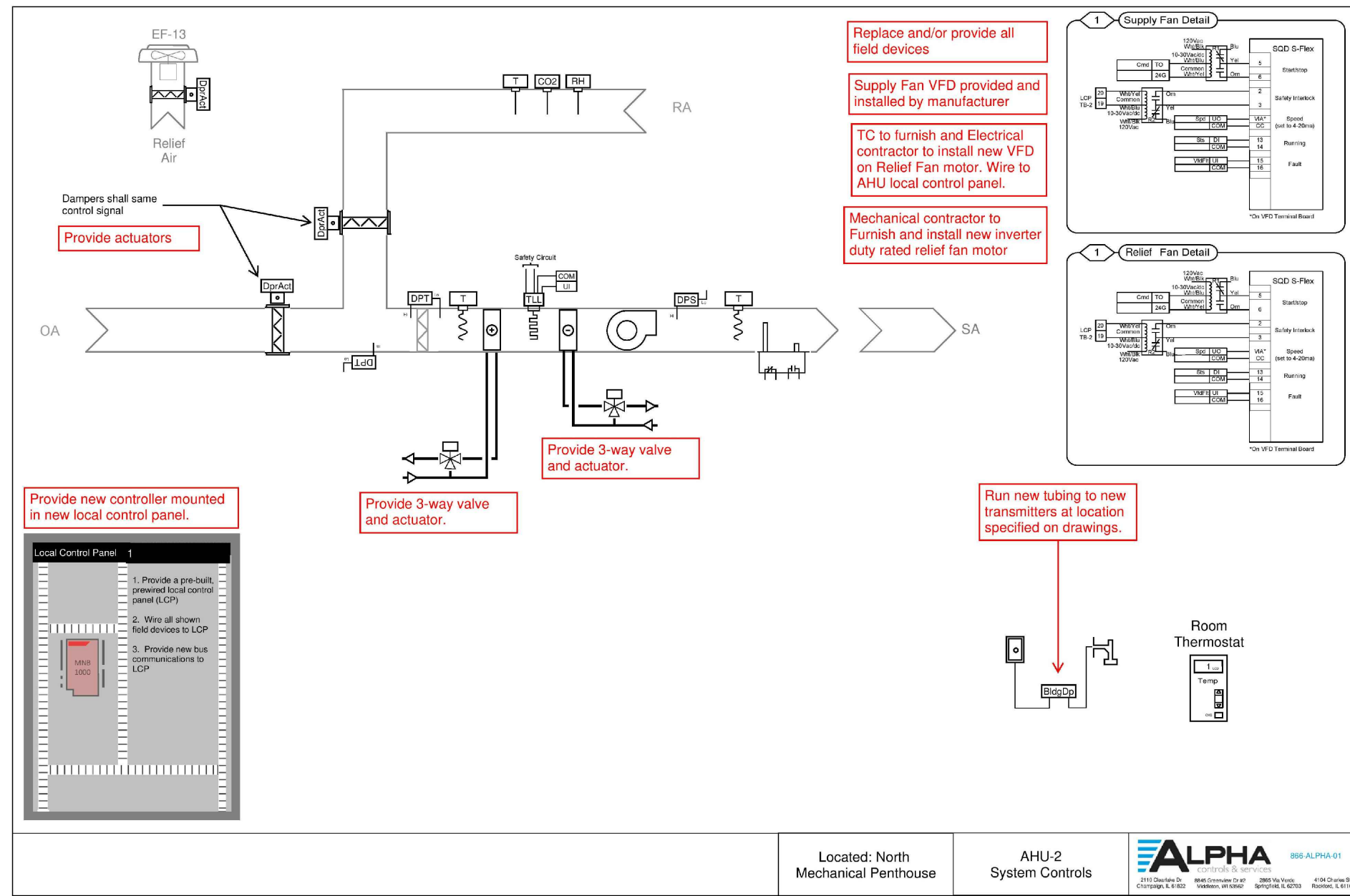
**SCHEDULES - HVAC**  
**SATELLITE JAIL HVAC REPLACEMENT**  
CHAMPAIGN COUNTY  
502 S UERMAN AVE URBANA, IL 61802

DESIGN: JMD	APPROVED: RCVN	SHEET: M-400
DATE: APRIL 23, 2021		95% CD
PROJECT: GHR # 7253		

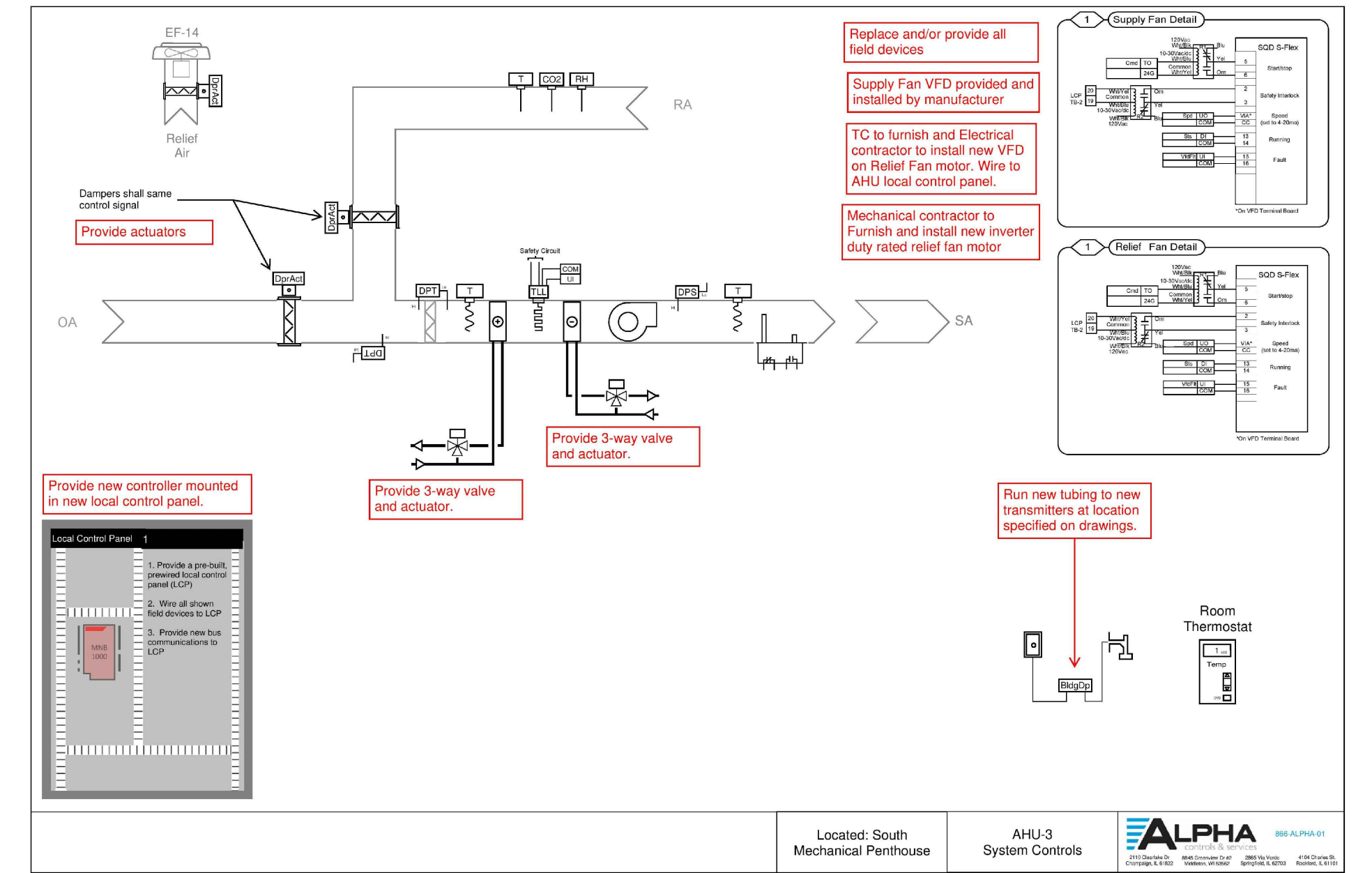




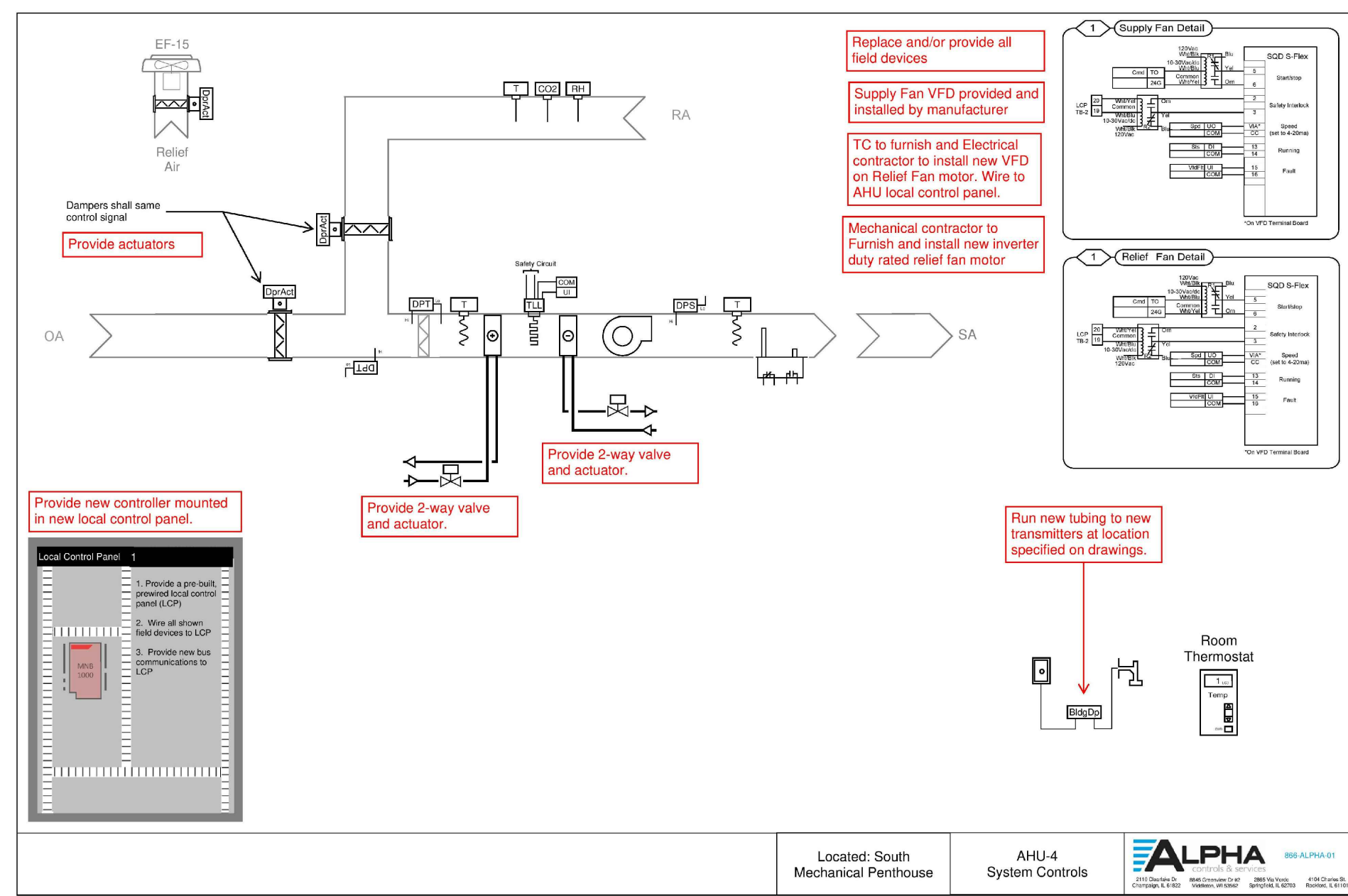
1 AHU-1 SYSTEM CONTROLS  
M-500 / NO SCALE



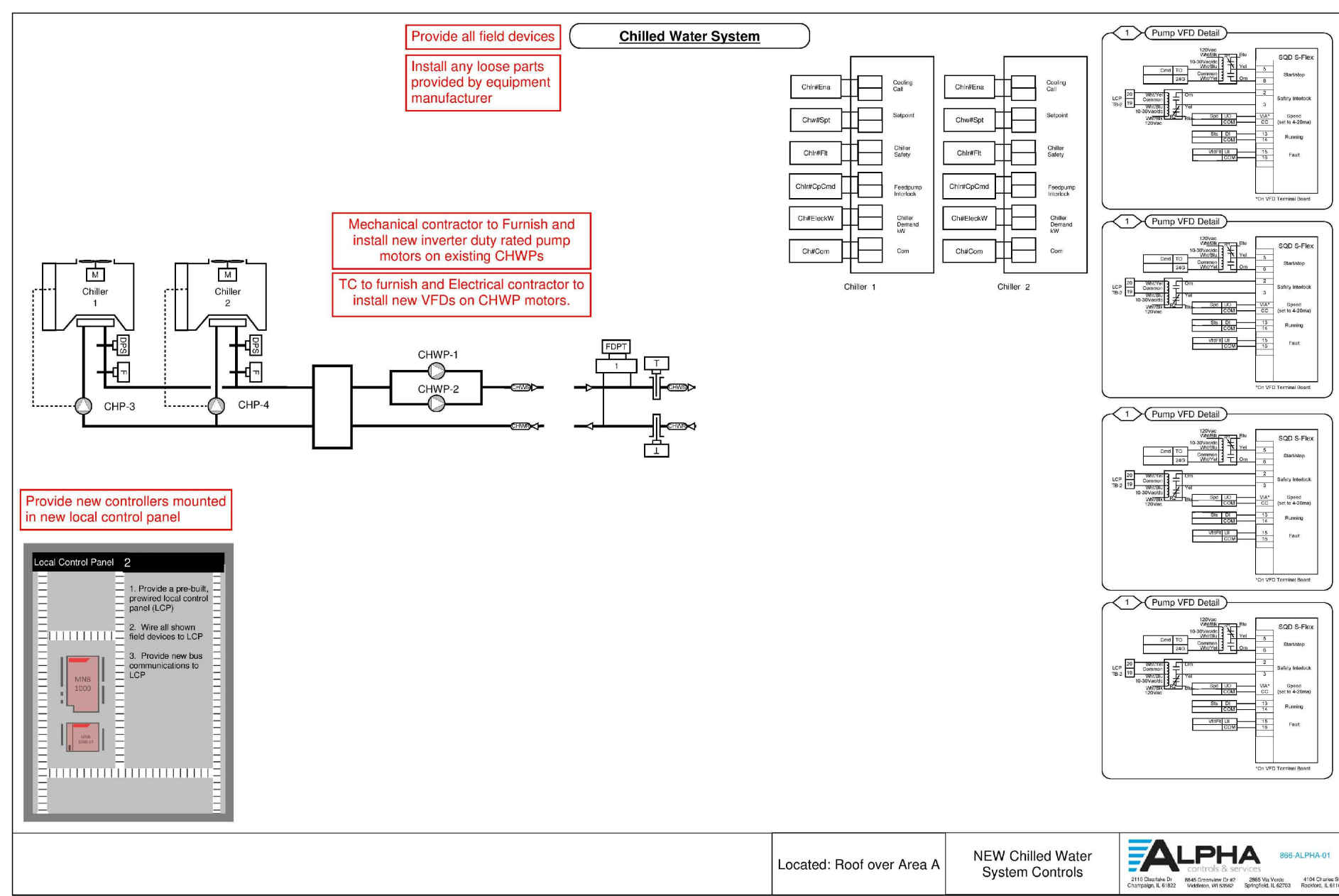
2 AHU-2 SYSTEM CONTROLS  
M-500 / NO SCALE



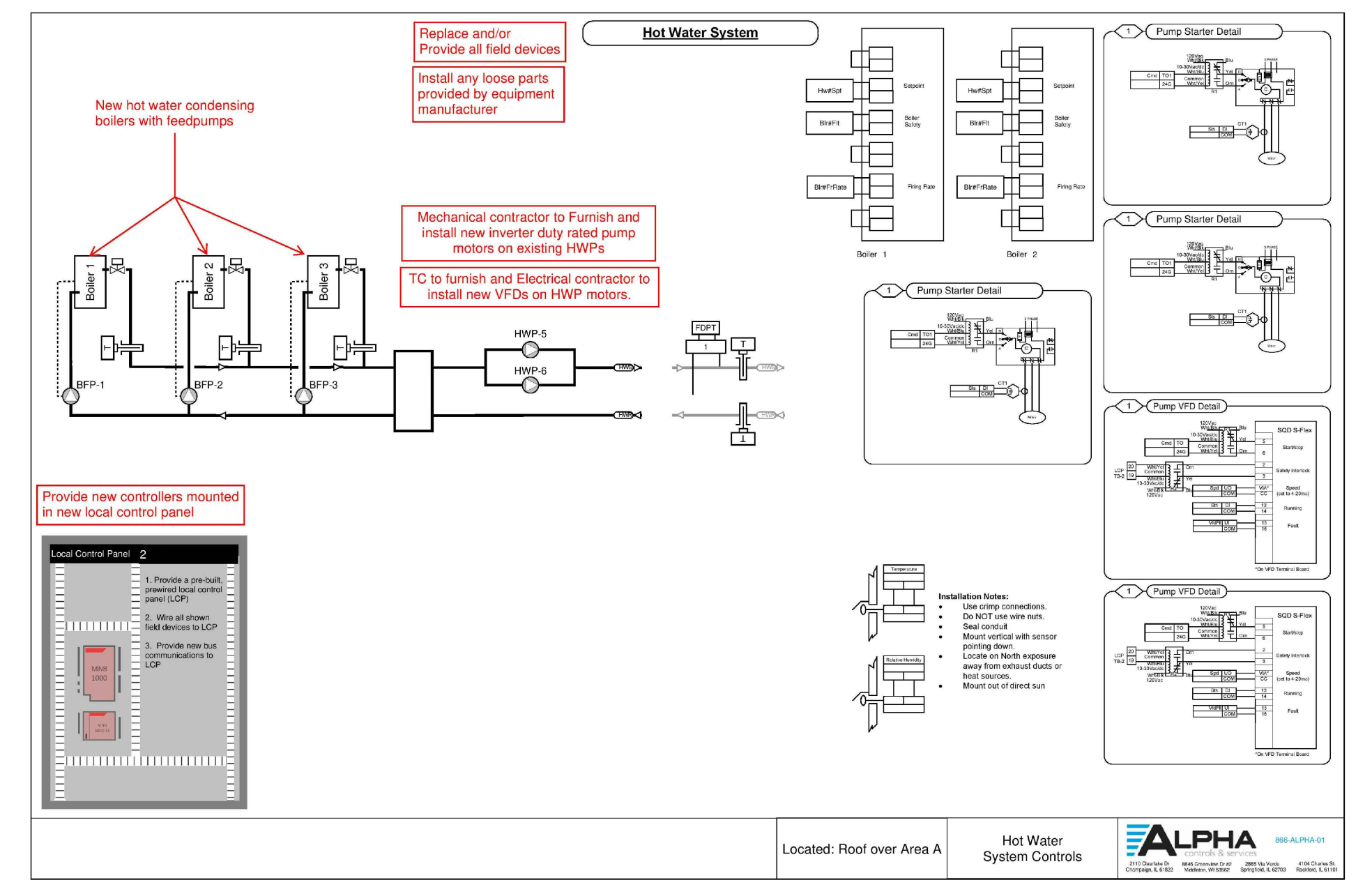
3 AHU-3 SYSTEM CONTROLS  
M-500 / NO SCALE



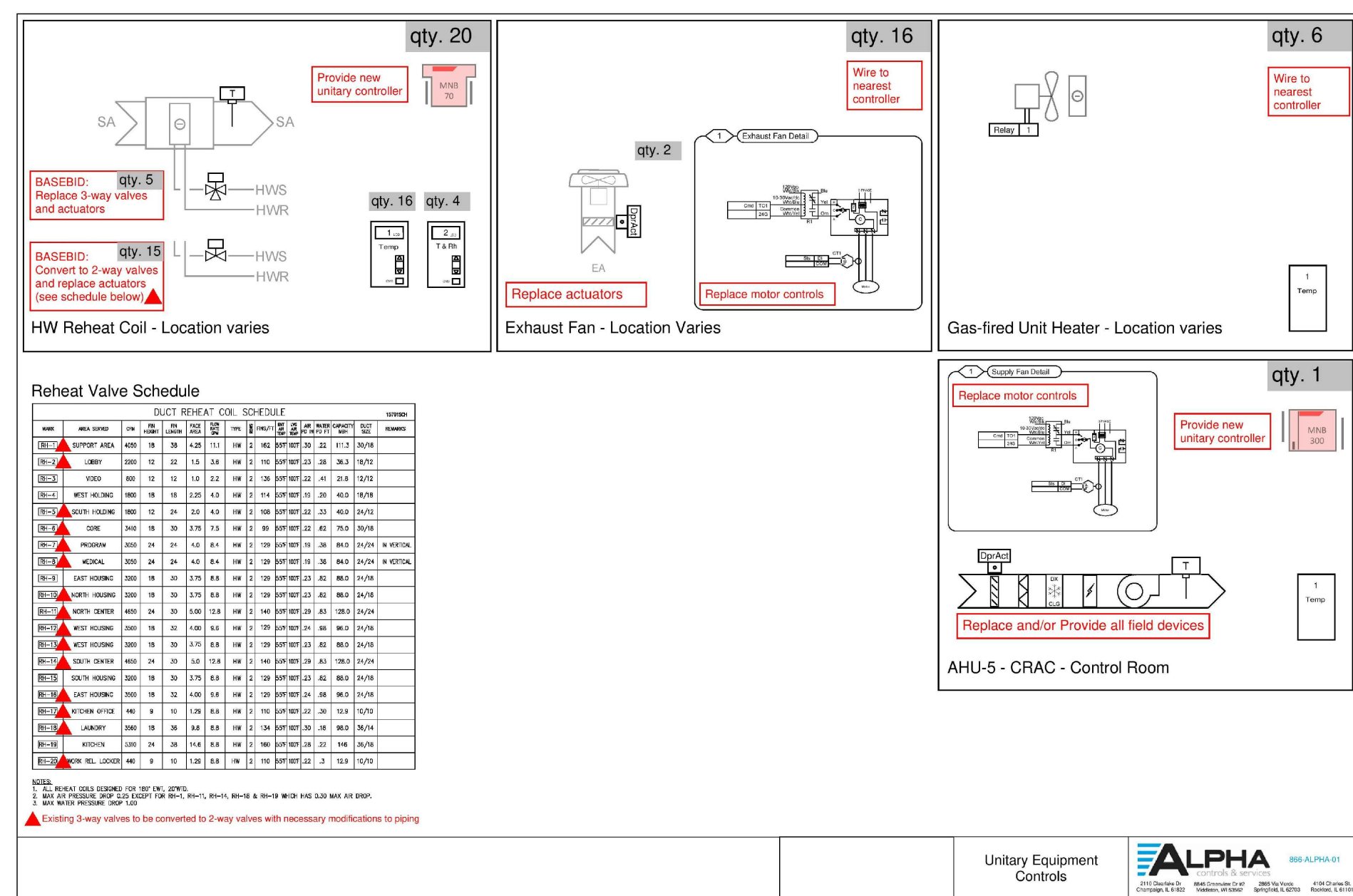
4 AHU-4 SYSTEM CONTROLS  
M-500 / NO SCALE



5 NEW CHILLED WATER SYSTEM CONTROLS  
M-500 / NO SCALE



6 HOT WATER SYSTEM CONTROLS  
M-500 / NO SCALE



7 UNITARY EQUIPMENT CONTROLS  
M-500 / NO SCALE

Tag	System	Fan	Existing VFD?	HP	Voltage	Replaces or Provide VFD?	Bypass	Existing Motor Inverter Duty Request?	Replace Motor	RPM	Frame Type	Motor Type	Grounding Ring Required?	Provide New Pulley and belts	Motor alignment request?	Pre and post air balance?
AHU-1-SF	New AHU-1	Supply	NA	10	480	By Manf.	Yes	NEW MOTOR	NA				Yes	Not applicable	No	Yes
AHU-2-SF	New AHU-2	Supply	NA	30	480	By Manf.	Yes	NEW MOTOR	NA				Yes	Not applicable	No	Yes
EP-13	Existing AHU-2 Relief	Relief	NA	3	480	Provide	Yes	No	Yes			DDP	Yes	Not applicable	No	Yes
AHU-3-SF	New AHU-3	Supply	NA	30	480	By Manf.	Yes	NEW MOTOR	NA				Yes	Not applicable	No	Yes
EP-14	Existing AHU-3 Relief	Relief	NA	3	480	Provide	Yes	No	Yes			DDP	Yes	Not applicable	No	Yes
AHU-4-SF	New AHU-4	Supply	NA	10	480	By Manf.	Yes	NEW MOTOR	NA				Yes	Not applicable	No	Yes
EP-15	Existing AHU-4 Relief	Relief	NA	3	480	Provide	Yes	No	Yes			DDP	Yes	Not applicable	No	Yes
CHWP-1	New Chilled Water Loop	Secondary	NA	TBD	TBD	Provide	Yes	NEW MOTOR	NA				Yes	Not applicable	Yes	Yes
CHWP-2	New Chilled Water Loop	Secondary	NA	TBD	TBD	Provide	Yes	NEW MOTOR	NA				Yes	Not applicable	Yes	Yes
CHP-3	New Chiller-3 Pump	Primary	NA	TBD	TBD	Provide	Yes	NEW MOTOR	NA				Yes	Not applicable	Yes	Yes
CHP-4	New Chiller-2 Pump	Primary	NA	TBD	TBD	Provide	Yes	NEW MOTOR	NA				Yes	Not applicable	Yes	Yes
HWP-5	New Hot Water Loop	Secondary	NA	TBD	TBD	Provide	Yes	NEW MOTOR	NA				Yes	Not applicable	Yes	Yes
HWP-6	New Hot Water Loop	Secondary	NA	TBD	TBD	Provide	Yes	NEW MOTOR	NA				Yes	Not applicable	Yes	Yes
BP-1	New Boiler-1 Feed Pump	Primary	NA	TBD	TBD	No	No	NEW MOTOR	NA				Yes	Not applicable	No	Yes
BP-2	New Boiler-2 Feed Pump	Primary	NA	TBD	TBD	No	No	NEW MOTOR	NA				Yes	Not applicable	No	Yes
BP-3	New Boiler-3 Feed Pump	Primary	NA	TBD	TBD	No	No	NEW MOTOR	NA				Yes	Not applicable	No	Yes

Field verify voltage & horsepower prior to ordering  
All new motors shall be Inverter duty rated  
TC to furnish VFDs and slip to electrical contractor  
Mechanical contractor shall furnish and install motors

VFD and Motor Schedule  
ALPHA

8 VFD AND MOTOR SCHEDULE  
M-500 / NO SCALE

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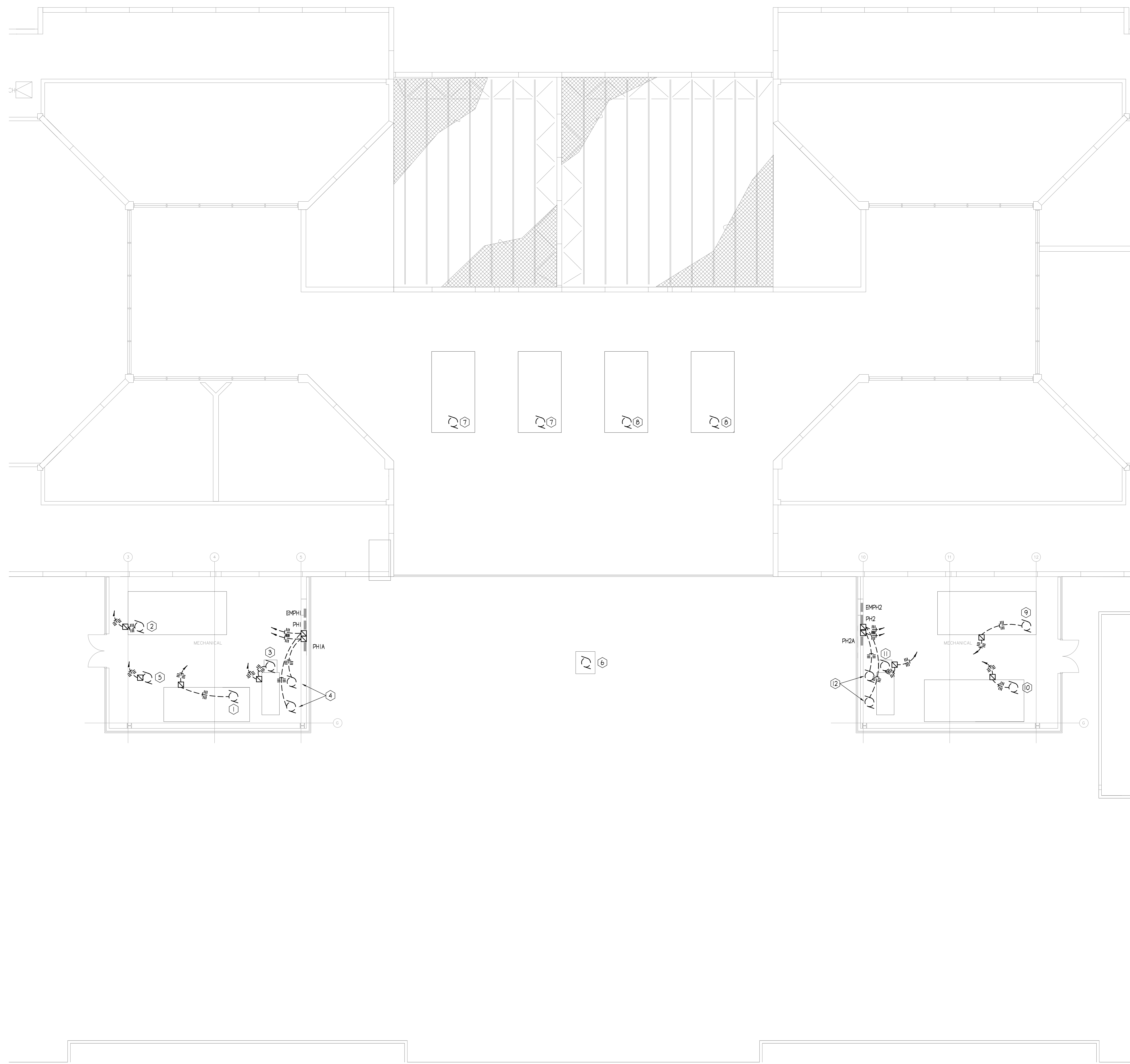
**GHR ENGINEERS AND ASSOCIATES, INC.**  
Mechanical & Electrical Consulting Engineers  
1615 South Neil Street, Champaign, Illinois 61820  
217-356-0536 Business - 217-356-1092 Fax

**CONTROLS DIAGRAMS - HVAC**  
**SATELLITE JAIL HVAC REPLACEMENT**  
CHAMPAIGN COUNTY  
502 S LIERMAN AVE URBANA, IL 61802

DATE: APRIL 23, 2021  
PROJECT: GHR # 7253  
DRAWN: JMD  
APPROVED: RCVN  
SHEET: M-500  
95% CD



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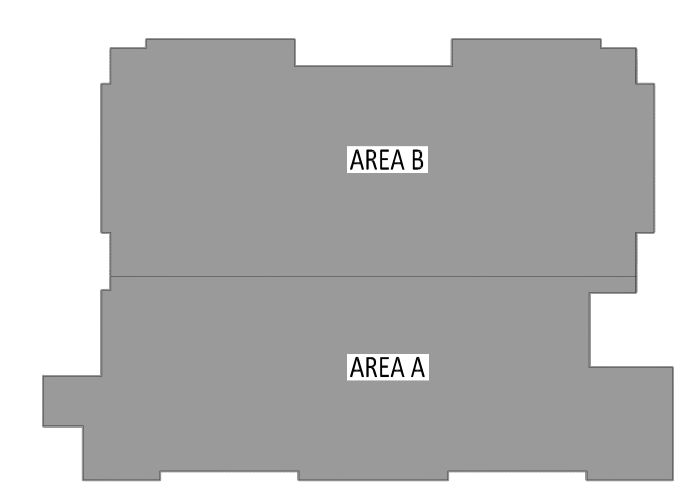


**KEYED NOTES**

- ① DISCONNECT EXISTING 'AHU-1' TO BE REMOVED BY OTHERS. REMOVE ASSOCIATED WIRING BACK TO SOURCE AND 3P-60A MOTOR STARTER. REMOVE ASSOCIATED 3P-45A CIRCUIT BREAKER FROM PANEL EMPH-1.
- ② DISCONNECT EXISTING 'AHU-2' TO BE REMOVED BY OTHERS. REMOVE ASSOCIATED WIRING BACK TO SOURCE AND 3P-60A MOTOR STARTER. REMOVE ASSOCIATED 3P-60A CIRCUIT BREAKER FROM PANEL EMPH-1.
- ③ DISCONNECT EXISTING BOILER #1 TO BE REMOVED BY OTHERS. REMOVE ASSOCIATED WIRING BACK TO SOURCE AND 3P-30A DISCONNECT. REMOVE ASSOCIATED 3P-20A CIRCUIT BREAKER FROM PANEL EMPH-1.
- ④ DISCONNECT EXISTING HOT WATER PUMPS (HP-1 & HP-2) TO BE REMOVED BY OTHERS. REMOVE ASSOCIATED WIRING AND 3P-30A MOTOR STARTERS. REMOVE ASSOCIATED 3P-25A CIRCUIT BREAKERS FROM PANEL EMPH-1.
- ⑤ DISCONNECT AND REMOVE EXISTING AIR COMPRESSOR. REMOVE ASSOCIATED WIRING AND 3P-30A DISCONNECT. REMOVE ASSOCIATED 3P-20A CIRCUIT BREAKER FROM PANEL EMPH-1.
- ⑥ DISCONNECT EXISTING AIR COOLED CONDENSING UNIT 'ACCU-5' TO BE REMOVED BY OTHERS. PRESERVE ASSOCIATED WIRING BUT REMOVE ASSOCIATED 3P-20A CIRCUIT BREAKER FROM PANEL EM.
- ⑦ DISCONNECT EXISTING AIR COOLED CONDENSING UNIT (ACCU-1 & ACCU-2) TO BE REMOVED BY OTHERS. REMOVE ASSOCIATED WIRING AND REMOVE ASSOCIATED 3P-150A CIRCUIT BREAKERS FROM PANEL PH-1.
- ⑧ DISCONNECT EXISTING AIR COOLED CONDENSING UNIT (ACCU-3 & ACCU-4) TO BE REMOVED BY OTHERS. REMOVE ASSOCIATED WIRING AND REMOVE ASSOCIATED 3P-150A CIRCUIT BREAKER (ACCU-3) AND 3P-125A CIRCUIT BREAKER (ACCU-4) FROM PANEL PH-2.
- ⑨ DISCONNECT EXISTING 'AHU-3' TO BE REMOVED BY OTHERS. REMOVE ASSOCIATED WIRING BACK TO SOURCE AND 3P-60A MOTOR STARTER. REMOVE ASSOCIATED 3P-60A CIRCUIT BREAKER FROM PANEL EMPH-2.
- ⑩ DISCONNECT EXISTING 'AHU-4' TO BE REMOVED BY OTHERS. REMOVE ASSOCIATED WIRING BACK TO SOURCE AND 3P-60A MOTOR STARTER. REMOVE ASSOCIATED 3P-45A CIRCUIT BREAKER FROM PANEL EMPH-2.
- ⑪ DISCONNECT EXISTING BOILER #2 TO BE REMOVED BY OTHERS. REMOVE ASSOCIATED WIRING BACK TO SOURCE AND 3P-30A DISCONNECT. REMOVE ASSOCIATED 3P-20A CIRCUIT BREAKER FROM PANEL EMPH-2.
- ⑫ DISCONNECT EXISTING HOT WATER PUMPS (HP-3 & HP-4) TO BE REMOVED BY OTHERS. REMOVE ASSOCIATED WIRING AND 3P-30A MOTOR STARTERS. REMOVE ASSOCIATED 3P-25A CIRCUIT BREAKERS FROM PANEL EMPH-2.

**ROOF PLAN - ELECTRICAL**  
 SCALE: 1/8" = 1'-0"

**KEY PLAN**  
 NO SCALE



DATE	NO.	DESCRIPTION

**GHR ENGINEERS AND ASSOCIATES, INC.**  
 Mechanical & Electrical Consulting Engineers  
 1615 South Neil Street, Champaign, Illinois 61820  
 217-356-0536 Business - 217-356-1092 Fax

**ROOF PLAN - ELECTRICAL**  
**SATELLITE JAIL HVAC REPLACEMENT**  
 CHAMPAIGN COUNTY  
 502 S LIERMAN AVE URBANA, IL 61802

DATE:	APRIL 23, 2021
PROJECT:	GHR # 7253

DRAWN:	DAK	APPROVED:	RCVN
DATE:	APRIL 23, 2021	PROJECT:	GHR # 7253

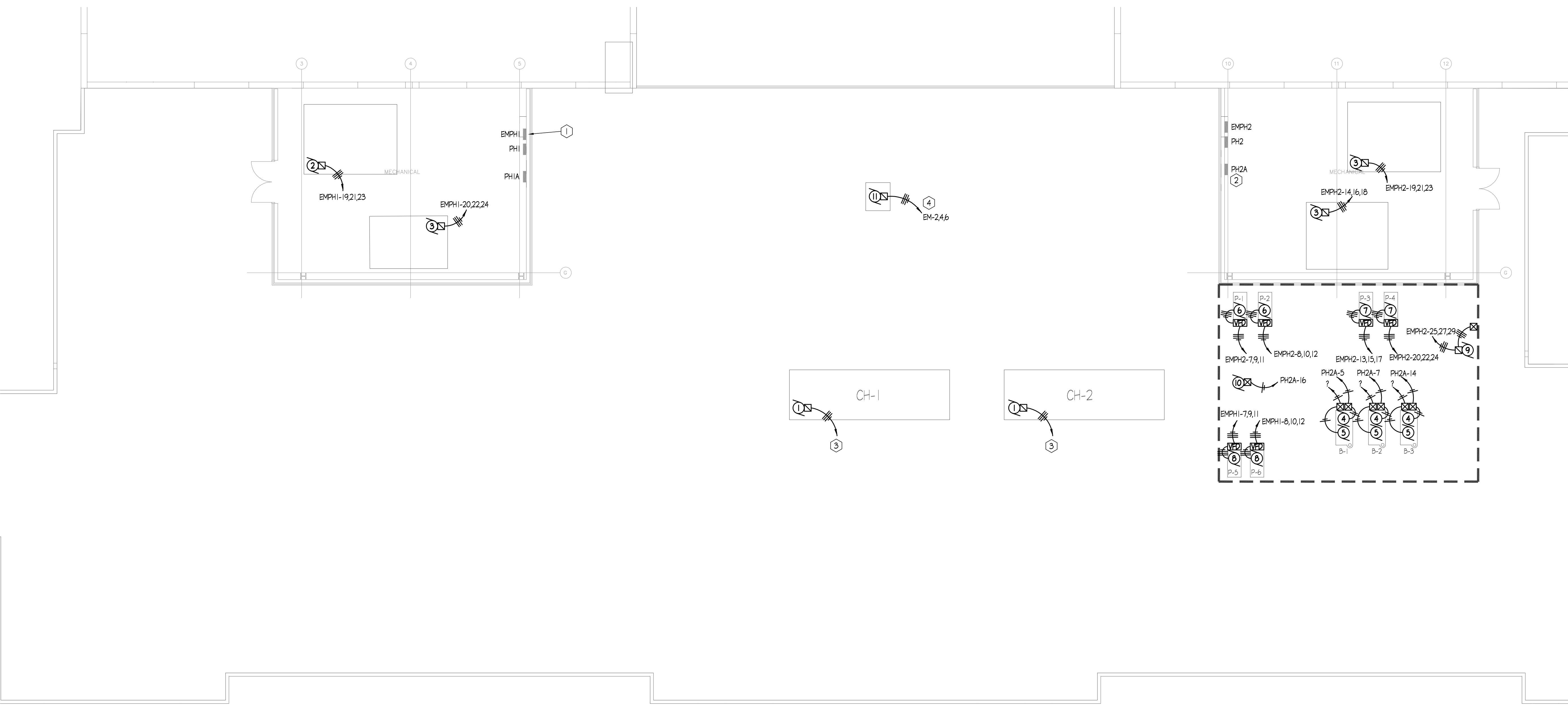
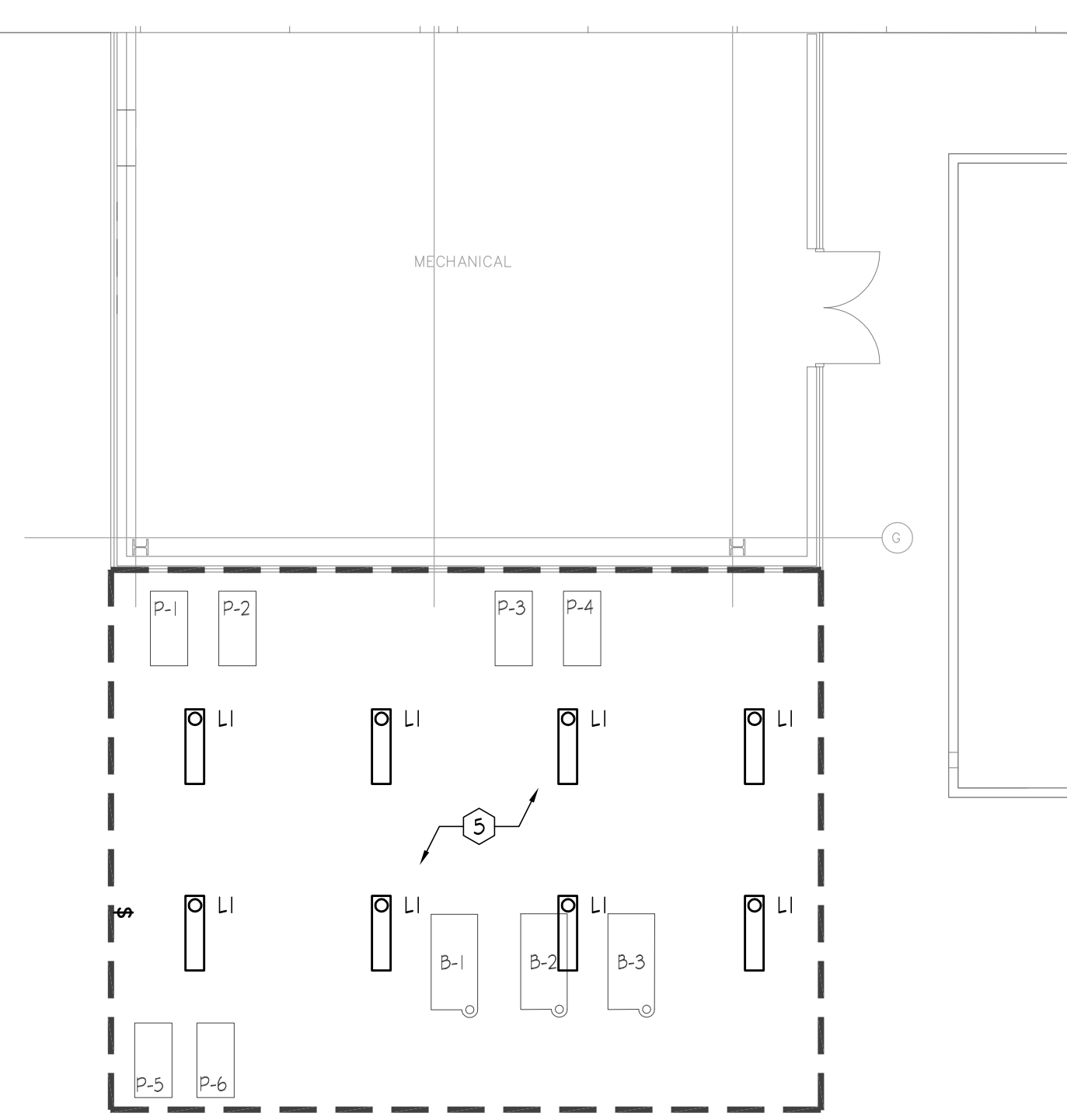
SHEET: **ED-103**  
 642

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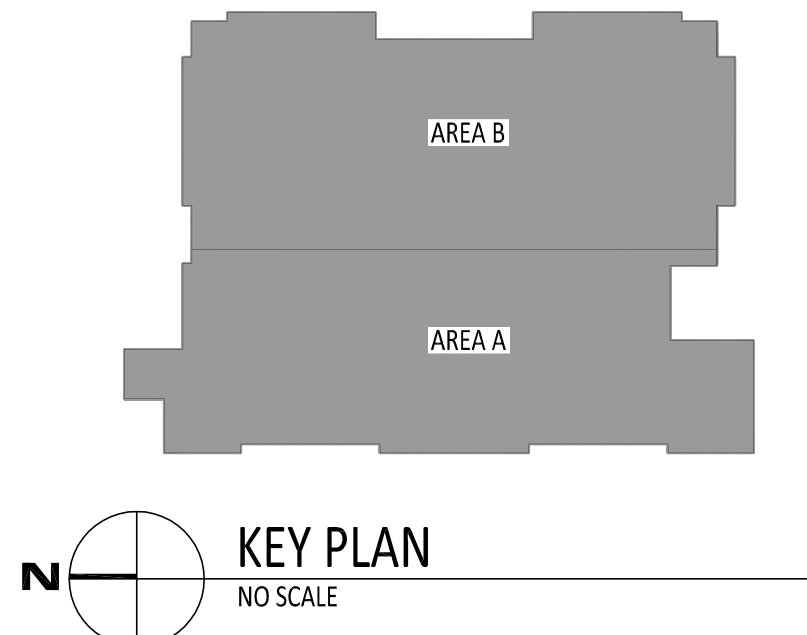
**KEYED NOTES**

- 1 INSTALL 3P-30A CIRCUIT BREAKER IN PLACE OF 3P-45A CIRCUIT BREAKER PREVIOUSLY SERVING AHL-1.
- 2 INSTALL 1P-40A CIRCUIT BREAKER IN PLACE OF SPARE 2P-20A CIRCUIT BREAKER. NEW CIRCUIT BREAKER SHALL SERVE 6UH-7.
- 3 INSTALL 2P 3P-450A CIRCUIT BREAKERS IN AVAILABLE SPACE OF MAIN SWITCH BOARD 'BSS' TO SERVE NEW CHILLERS.
- 4 INSTALL 3P-25A CIRCUIT BREAKERS IN PANEL 'EM' IN PLACE OF 3P-20A CIRCUIT BREAKER PREVIOUSLY SERVING ACQU-5.
- 5 INTERCEPT AND EXTEND LIGHTING CIRCUIT SERVING EXISTING EAST PENTHOUSE TO NEW LIGHT FIXTURES. NEW FIXTURES TO BE CONTROLLED BY NEW SINGLE POLE LIGHT SWITCH IN NEW PENTHOUSE.

**ROOF PLAN - LIGHTING**  
SCALE: 1/8" = 1'-0"



**ROOF PLAN - POWER**  
SCALE: 1/8" = 1'-0"



**KEY PLAN**  
NO SCALE

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Mechanical & Electrical Consulting Engineers  
1615 South Neil Street, Champaign, Illinois 61820  
217-356-0536 Business - 217-356-1092 Fax

**ROOF PLAN - ELECTRICAL**  
**SATELLITE JAIL HVAC REPLACEMENT**  
CHAMPAIGN COUNTY  
502 S LIERMAN AVE URBANA, IL 61802

SIN: \_\_\_\_\_

DRAWN: DAK APPROVED: RCVN  
DATE: APRIL 23, 2021  
PROJECT: 95% CD  
GHR # 7253

SHEET: **E-103**  
643

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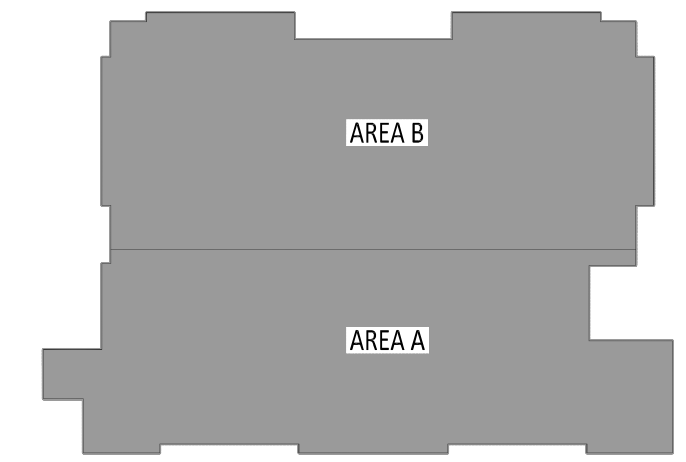
SCHEDULE OF MOTOR STARTERS ETC.																					
ITEM NO.	EQUIPMENT DESCRIPTION	MOTOR H.P.	ELEC. K.W.	PHASE	LINE VOLTAGE	INTEGRAL FUSED DISC. SW.	STARTER SIZE	STARTER TYPE	MANUAL STARTER W/PILOT	CONTROL LOCATION	SW & FUSE OR BREAKER POLE & AMPS	CONDUCTOR SIZE & NO.	CONDUIT SIZE	DISCONNECT MEANS ADJACENT TO MOTOR	MOTOR LOCATION	MOUNT IN DOOR OF STARTER	AUX. CONTACT REQ'D	NOTES, REFERENCES AND REMARKS			
																P.B.	H.O.A.	P.L.	N.O.	N.C.	
1	CHILLER CH-1, CH-2	-	-	3	480		4			AT MOTOR	3P-450A	3#4/0 & 1#2 GND.	2 1/2"	SEE NOTE #1	AS SHOWN	-	-	-	-	-	MCA: 408A MOCP: 450A
2	AIR HANDLING UNIT AHU-1	10	-	3	480		4			AT MOTOR	3P-30A	3#12 & 1#12 GND.	3/4"	SEE NOTE #2	AS SHOWN	-	-	-	-	-	MCA: 17.9A MOCP: 30A
2	AIR HANDLING UNIT AHU-2, AHU-3, AHU-4	20	-	3	480		4			AT MOTOR	3P-60A	3#6 & 1#10 GND.	3/4"	SEE NOTE #2	AS SHOWN	-	-	-	-	-	MCA: 33.8A MOCP: 60A
4	BOILER MOTOR B-1, B-2, B-3	-	-	1	120	-	-	MMS	*	AT MOTOR	1P-20A	3#12 & 1#12 GND.	3/4"	MMS	AS SHOWN	-	-	-	-	-	FLA: 13A
5	BOILER PUMP MOTOR BP-1, BP-2, BP-2	-	-	3	208	-	-	MMS	*	AT MOTOR	3P-20A	3#12 & 1#12 GND.	3/4"	MMS	AS SHOWN	-	-	-	-	-	FLA: 6.5A
6	CHILLED WATER PUMP P-1, P-2	7.5	-	3	480		3			AT MOTOR	3P-30A	3#12 & 1#12 GND.	3/4"	SEE NOTE #2	AS SHOWN	-	-	-	-	-	
7	CHILLED WATER PUMP P-3, P-4	15	-	3	480		3			AT MOTOR	3P-60A	3#10 & 1#10 GND.	3/4"	SEE NOTE #2	AS SHOWN	-	-	-	-	-	
8	CHILLED WATER PUMP P-5, P-6	10	-	3	480		3			AT MOTOR	3P-35A	3#12 & 1#12 GND.	3/4"	SEE NOTE #2	AS SHOWN	-	-	-	-	-	
9	EXHAUST FAN EF-20	1	-	3	480	-	-	MMS	*	AT MOTOR	3P-20A	3#12 & 1#12 GND.	3/4"	SEE NOTE #1	AS SHOWN	-	-	-	-	-	FLA: 2.1A
10	GAS UNIT HEATER GUH-7	1.5	-	1	120	2P-60A	1	FVNR	-	AT MOTOR	1P-40A	2#10 & 1#10 GND.	3/4"	SEE STARTER	AS SHOWN	-	-	-	-	-	FLA: 17.7A
11	AC CONDENSING UNIT ACCU-5	-	-	3	208		4			AT MOTOR	3P-25	3#12 & 1#12	3/4"	SEE NOTE #1	AS SHOWN	-	-	-	-	-	FLA: 14.4A MCA:17.1A MOCP: 25A

KEYED NOTES AND ABBREVIATIONS FOR MOTOR STARTER SCHEDULE

FVNR	FULL VOLTAGE NON REVERSING	FDS	FUSED DISCONNECT SWITCH	PB	PUSH BUTTON	A	AMPS
MMS	MANUAL MOTOR STARTER	NFDS	NON FUSED DISCONNECT SWITCH	HOA	HAND-OFF-AUTO SELECTOR	P	POLE
CSDS	COMBINATION STARTER/DISCONNECT SWITCH	WPPDS	WEATHERPROOF FUSED DISCONNECT SWITCH	PL	PILOT LIGHT	HP	HORSEPOWER
VFD	VARIABLE FREQUENCY DRIVE	WPNFDS	WEATHERPROOF NON FUSED DISCONNECT SWITCH	NO	NORMALLY OPEN	KW	KILOWATT
STCB	SHUNT TRIP CIRCUIT BREAKER	HACR	HEATING, AIR CONDITIONING, REFRIGERATION RATED	NC	NORMALLY CLOSED	FLA	FULL LOAD AMPS
MCC	MOTOR CONTROL CENTER	MSS	MOTOR STARTING SWITCH				

- ① DISCONNECT SWITCH FURNISHED INTEGRAL WITH UNIT BY MANUFACTURER.
- ② DISCONNECT SWITCH AT UNIT FURNISHED INTEGRAL WITH VFD.
- ③ VFD FURNISHED BY OTHERS AND INSTALLED BY ELECTRICAL CONTRACTOR.
- ④ STARTER FURNISHED INTEGRAL WITH UNIT BY MANUFACTURER.

LIGHT FIXTURE SCHEDULE													
FIXTURE NUMBER	MANUFACTURER AND CATALOG NUMBER	DESCRIPTION	LAMPS			FIXTURE MOUNTING			FIXTURE LOCATION			FINISH	REMARKS
			LED	INCAND.	HID	QUANTITY	TYPE	RECESSED SURFACE	PENDANT	SUSPENDED	CEILING		
L1	LITHONIA LUFIT-L48-6000LM-5EF-MVOLT-GZ10-35K-80CRI	48" LED STRIPLIGHT	•			1	6000 NOMINAL LUMENS 3500K	•		•		MATTE WHITE	COLD ROLLED STEEL HOUSING, MULTI-VOLT OPERATION, HIGH POWER FACTOR LED DRIVER, 0-10V DIMMING DOWN TO 10 PERCENT.



KEY PLAN  
NO SCALE

DATE	NO.	DESCRIPTION

**GHR ENGINEERS AND ASSOCIATES, INC.**  
 Mechanical & Electrical Consulting Engineers  
 1615 South Neil Street, Champaign, Illinois 61820  
 217-356-0536 Business - 217-356-1092 Fax

**ELECTRICAL SCHEDULES**  
**SATELLITE JAIL HVAC REPLACEMENT**  
 CHAMPAIGN COUNTY  
 502 S LIERMAN AVE URBANA, IL 61802

SIG.
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DRAWN: DAK	APPROVED: RCVN
DATE: APRIL 23, 2021	
PROJECT: GHR # 7253	

SHEET:  
**E-400**  
 644

## LEASE AGREEMENT BETWEEN THE COUNTY OF CHAMPAIGN AND THE URBANA PARK DISTRICT

**THIS LEASE AGREEMENT** is made and entered into this **first day of June 2021**, by and between the County of Champaign (hereinafter referred to as "Landlord") and the Urbana Park District (hereinafter referred to as "Tenant").

### ARTICLE I

#### Premises

Landlord does hereby lease to Tenant space located in POD #400 of the Champaign County Brookens Administrative Center, which is located at 1776 East Washington Street, Urbana, Illinois. The Tenant will lease 12,957 square feet of space on the first floor and 875 square feet of space on the east mezzanine during the period of **June 1, 2021-May 31, 2026**. The space leased is identified in the floor plan of the Brookens Administrative Center, which is attached as Exhibit "A".

### ARTICLE II

#### Term

This lease agreement shall be in effect for five successive one-year terms, commencing on **June 1, 2021**. Each one-year term commences on **June 1** and ends on **May 31**. This lease agreement terminates on May 31, 2026. Either party may terminate this lease agreement, for any reason, with written notification at least one hundred and twenty (120) days prior to the end of each one-year term.

### ARTICLE III

#### Rent

Rent for said premises shall be at the following rates:

- a) From June 1, 2021 to May 31, 2022 - The rent for this term shall be **\$54,848.00** annually (\$3.84 x 12,957 sq. ft. and \$5.82 x 875 sq. ft.).
- b) From June 1, 2022 to May 31, 2023 - The rent for this term shall be \$54,848.00 multiplied by the percent increase to CPI (as documented to Champaign County by the Illinois Department of Revenue in January 2022, to determine the maximum extension under the Property Tax Extension Limitation Law), except if the CPI is negative, then the rent shall be adjusted by 0%, and if the CPI exceeds 5%, the rent increase shall be capped at 5%.
- c) From June 1, 2023 to May 31, 2024 - The rent for this term shall be the amount paid from June 1, 2022 to May 31, 2023 multiplied by the percent increase to CPI (as documented to Champaign County by the Illinois Department of Revenue in January 2023, to determine the maximum extension under the Property Tax Extension Limitation Law), except if the CPI is negative, then the rent shall be adjusted by 0%, and if the CPI exceeds 5%, the rent increase shall be capped at 5%.
- d) From June 1, 2024 to May 31, 2025 - The rent for this term shall be the amount paid from June 1, 2023 to May 31, 2024 multiplied by the percent increase to CPI (as documented to Champaign County by the Illinois Department of Revenue in January 2024, to determine the maximum extension under the Property Tax Extension Limitation Law), except if the CPI is negative, then the rent shall be adjusted by 0%, and if the CPI exceeds 5%, the rent increase shall be capped at 5%.
- e) From June 1, 2025 to May 31, 2026 - The rent for this term shall be the amount paid from June 1, 2024 to May 31, 2025 multiplied by the percent increase to CPI (as documented to Champaign County by the Illinois Department of Revenue in January 2025, to determine the maximum extension under the Property Tax Extension Limitation Law),

except if the CPI is negative, then the rent shall be adjusted by 0%, and if the CPI exceeds 5%, the rent increase shall be capped at 5%.

#### **ARTICLE IV**

##### **Utilities**

At no additional cost to Tenant, Landlord shall provide electric current, plumbing, and heat and air conditioning during the appropriate seasons. Landlord shall not be liable for failure to furnish or for suspension or delays in furnishing any utilities caused by breakdown, maintenance or repair work, strike, riot, civil disturbance, or any cause or reason whatsoever beyond the control of the Landlord.

#### **ARTICLE V**

##### **Use of Premises**

- a) Tenant shall use and occupy the leased premises for recreational activities for the Citizens of Urbana and Champaign County, and for no other purpose whatsoever without the prior written consent of Landlord. Tenant shall not use or permit the leased premises or any part thereof to be used for any disorderly, unlawful, or extra hazardous purpose.
- b) Tenant shall commit no act of waste and shall take good care of the leased premises and the fixtures and appurtenances therein, and shall, in the use and occupancy of the leased premises, conform to all laws, orders, and regulations of the federal, state and municipal or local governments or any of their departments. Tenant further agrees to save Landlord harmless from all fines, penalties, and costs for violations or of noncompliance with the same.
- c) Tenant shall not use or permit the use of machinery or equipment which shall cause an unreasonable consumption of utilities within the leased premises beyond that made known to Landlord at the time of execution of this lease.
- d) Tenant shall not use any equipment or engage in any activity on the leased premises which shall cause an increase in the insurance rate of the Brookens Administrative Center or which shall create or cause undue expense to Landlord for maintenance and/or utilities.
- e) At the expiration or other termination of this lease, Tenant shall surrender and deliver the leased premises in as good a condition as when Tenant first received possession of the leased premises, ordinary wear and tear, and damage by the elements, fire, and other unavoidable casualty excepted. Tenant shall serve upon Landlord within ninety (90) days of commencement of this lease written notice specifying what parts, if any, of the leased premises are not in good order.

#### **ARTICLE VI**

##### **Tenant's Responsibilities**

The Tenant shall, for the period of the lease, maintain the leased premises in the following manner:

- a) Cut all grass of the Brookens Administrative Center properties in the same manner as it has for the past twenty years of the original lease, identified in Appendix B. Mowing should be done on a reasonable schedule, which is approved by the Landlord;
- b) Provide snow removal for the North parking lot C of Brookens Administrative Center, identified in Appendix C, when the snow is 1" or more, prior to 7:00am on weekdays;
- c) Provide plantings for and maintain a flower garden in a mini-park area near the Brookens Center signs located at the corner of Washington and Lierman, and, by the Urbana Park District entrance to POD #400;
- d) Provide janitorial services for areas of POD#400, which are occupied by the Tenant.

#### **ARTICLE VII**

## Insurance

Tenant shall, at its expense, maintain public liability and property damage insurance with the liability limits of not less than \$2,000,000.00 per occurrence and \$4,000,000.00 aggregate, and property limits of not less than \$2,000,000.00 per occurrence and \$4,000,000.00 aggregate insuring against liability of Landlord and its authorized representatives arising out of and in connection with Tenant's use of occupancy of the leased space.

The County of Champaign shall be named as an additional insured on the insurance policy.

All insurance required under this lease shall:

- a) Be issued by insurance companies authorized to do business in the State of Illinois, with a financial rating of at least A+ #A status as rated in the most recent edition of Best's Insurance Reports;
- b) Be issued as a primary policy;
- c) Contain an endorsement requiring 30 days' written notice from the Insurance Company to both parties before cancellation or change in the coverage, scope, or amount of any policy;
- d) Be renewed no less than 20 days before the expiration of the term of the policy.

Each policy, or a certificate of the policy, together with evidence of payment of premiums, shall be deposited with the Landlord at the commencement of the term and on each renewal of the policy.

## ARTICLE VIII

### Subletting and Assignment

Tenant shall not, without first obtaining the written consent of Landlord, assign, mortgage, pledge, or encumber this lease, or sublet the leased premises or any part thereof.

## ARTICLE IX

### Alterations

a) Tenant will not make any alterations, installations, changes, replacements, additions or improvements (structural or otherwise) in or to the leased premises or any part thereof, without the prior written approval of Landlord of the design, plans and specifications therefore, which approval shall not be unreasonably withheld. Tenant shall keep the leased premises and the building and grounds of which it is a part free and clear of liens arising out of any work performed, materials furnished, or obligations incurred by Tenant, including mechanic's liens.

b) It is distinctly understood that all alterations, installations, changes, replacement, additions, or improvements upon the leased premises made by the Tenant pursuant to (a) herein, shall, at the election of Landlord, remain upon the leased premises and be surrendered with the leased premises at the expiration of this lease without disturbance or injury. Should Landlord elect that same be removed upon termination of this lease or any extension thereof, Tenant hereby agrees to cause same to be removed at the sole cost and expense of Tenant. Should Tenant fail to remove same, then Landlord may cause same to be removed, and Tenant hereby agrees to reimburse Landlord for the cost of such removal together with any and all damages that Landlord may suffer and sustain by any reason of the failure of Tenant to remove the same.

c) Maintenance and repair of any items installed pursuant hereto shall be the sole responsibility of Tenant, and Landlord shall have no obligation in connection therewith.

d) Tenant shall promptly repair all damage caused to the leased premises or to the building and grounds of which the leased premises are a part occasioned by the installation or removal of any alteration made pursuant hereto.

## ARTICLE X

### Parking

Appendix C identifies Brookens Administrative Center Parking Lots A, B, C, and D.

- a) At no additional cost to Tenant, Tenant's employees and guests may park in the north parking lot C, located at the northern and northeastern portion of the property. Parking spaces shall be available on a first-come-first-served basis.
- b) Tenant's temporary business guests and visitors will be permitted to use the visitors' reserved parking spaces available off Washington Avenue, designated as Parking Lot A, and in the northeastern parking lot off of Lierman Avenue, designated as Parking Lot D. Parking spaces shall be available on a first-come-first-served basis.
- c) The Tenant shall allow the Landlord the daily use of Parking Lot B, for use by employees of the Brookens Administrative Center during regular Monday thru Friday business hours.

## **ARTICLE XI**

### **Signs, Notices, Advertisements, Etc.**

- a) Landlord shall place a sign with Tenant's name on the exterior of the building of which the leased premises is a part.
- b) Tenant shall not inscribe, print, affix, or otherwise place any sign, advertisement, or notice on the grounds, or the exterior or interior of the building of which the leased premises is a part, except on the doors of leased premises and only in a size, color and style approved by Landlord.

## **ARTICLE XII**

### **Damage to Premises**

If, without the fault of Tenant, the leased premises is damaged by fire or other casualty to such extent that the leased premises is totally destroyed, or if such damage occurs during the last six (6) months of a one-year term of this lease agreement, this lease agreement shall terminate and rent shall be abated beginning the day after the casualty event. In all other cases when the leased premises is damaged by fire or other casualty, without the fault of Tenant, Landlord shall repair the damage with reasonable dispatch, and if the damage has rendered the leased premises untenable, in whole or in part, there shall be an apportionment of the rent until the leased premises is wholly tenantable. However, should the leased premises not be restored to tenantable condition within three (3) months from the date of said damage, then Tenant may, at its option, cancel and terminate this lease in its entirety. In determining what constitutes reasonable dispatch, consideration shall be given to delays caused by strikes, adjustment of insurance, and other causes beyond Landlord's control. If the damage results from the fault of Tenant, or Tenant's agents, servants, visitors, or licensees, Tenant shall not be entitled to any abatement or reduction of rent.

No compensation, claim, or diminution of rent shall be allowed or paid by Landlord, by reason of inconvenience, annoyance, or injury to business, arising from the necessity of repairing the leased premises or any portion of the building of which it is a part, however the necessity may occur.

Landlord shall not be liable for damages for, nor shall this lease be affected by, conditions arising or resulting from construction on contiguous premises which may affect the building of which the leased premises is a part.

## **ARTICLE XIII**

### **Access**



Landlord, its agents and employees, shall have the right to enter the leased premises at all reasonable hours and necessary times to inspect the premises and to make the necessary repairs and improvements to the premises and the building in which the premises is located.

#### **ARTICLE XIV**

##### **Landlord's Remedies on Default**

If Tenant defaults in the payment of rent or defaults in the performance of any of the other covenants or conditions of this lease agreement, Landlord may give Tenant notice of the default. Rent default shall be cured within 15 days of the notice, and other defaults shall be cured within 21 days of the notice. Landlord may extend the time to cure if tenant fails to cure within the required time. On the date specified in the notice, or on the date specified by the Landlord's extension of time to cure, this lease agreement will terminate, and Tenant will then quit and surrender the premises to Landlord, and the Tenant will remain liable for any deficiencies in rent or damage to the property. If the lease is terminated because of Tenant's default, Landlord may at any time thereafter resume possession of the premises by any lawful means and remove Tenant or other occupants and its or their effects.

#### **ARTICLE XV**

##### **Cumulative Remedies and Waiver**

The specified remedies to which Landlord may resort under the terms of this lease are cumulative and are not intended to be exclusive of any other remedies or means of redress to which Landlord may be lawfully entitled in case of any breach or threatened breach by Tenant of any provision of this lease. The failure of Landlord to insist on strict performance of any covenant or condition of this lease or to exercise any option herein contained in any one instance shall not be construed as a waiver of such covenant, condition, or option in any other instance. No waiver by Landlord or any provision of this lease shall be deemed to have been made unless expressed in writing and signed by Landlord.

#### **ARTICLE XVI**

##### **Partial Invalidity**

Should any provision of this lease become or be declared to be invalid or unenforceable, the remaining provisions shall continue to be fully effective.

#### **ARTICLE XVII**

##### **Successors**

All the terms and provisions of this lease shall be binding upon and inure to the benefit of and be enforceable by and upon the representatives, successors, and assigns of Landlord and Tenant.

#### **ARTICLE XVIII**

##### **Notices and Payments**

All rent or other payments under this lease shall be paid to Landlord at Champaign County Treasurer's Office, 1776 East Washington Street, Urbana, Illinois, 61802, or at such other place as Landlord may from time to time designate by written notice to Tenant. All notices required or desired to be furnished to Landlord by Tenant shall be in writing and shall be furnished by mailing the same by certified mail to Landlord addressed to Champaign County Administrator/Facilities & Procurement, 1776 East Washington Street, Urbana, Illinois 61802. All notices to Tenant shall be in writing and shall be furnished by Landlord by mailing the same by certified mail addressed to Urbana Park District, 303 W. University Avenue, Urbana, IL 61801.

#### **ARTICLE XIX**

##### **Governing Law**

This lease shall be construed, enforced, and considered made in accordance with the laws of the State of Illinois.

**ARTICLE XX**

**Titles**

All titles, captions, and headings contained in this lease are for convenience only and shall not be taken into consideration in any construction or interpretation of this lease or any of its provisions.

**ARTICLE XXI**

**Entire Agreement**

The terms of this lease constitute the whole and entire agreement between the parties and supersede all prior understandings, discussions, agreements or otherwise between the parties hereto with respect to the subject matter hereof.

**ARTICLE XXII**

**Amendment**

No amendment to this lease shall be effective unless it is in writing and signed by the parties hereto.

IN WITNESS WHEREOF, the parties hereto have hereunto set their hands and seals the day and year first above written, in duplicate documents, each of which shall be considered an original.

**Landlord:**

**COUNTY OF CHAMPAIGN, ILLINOIS**

**By:** \_\_\_\_\_  
**Darlene Kloeppel, Executive**  
**Champaign County Executive**

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

**ATTEST:** \_\_\_\_\_

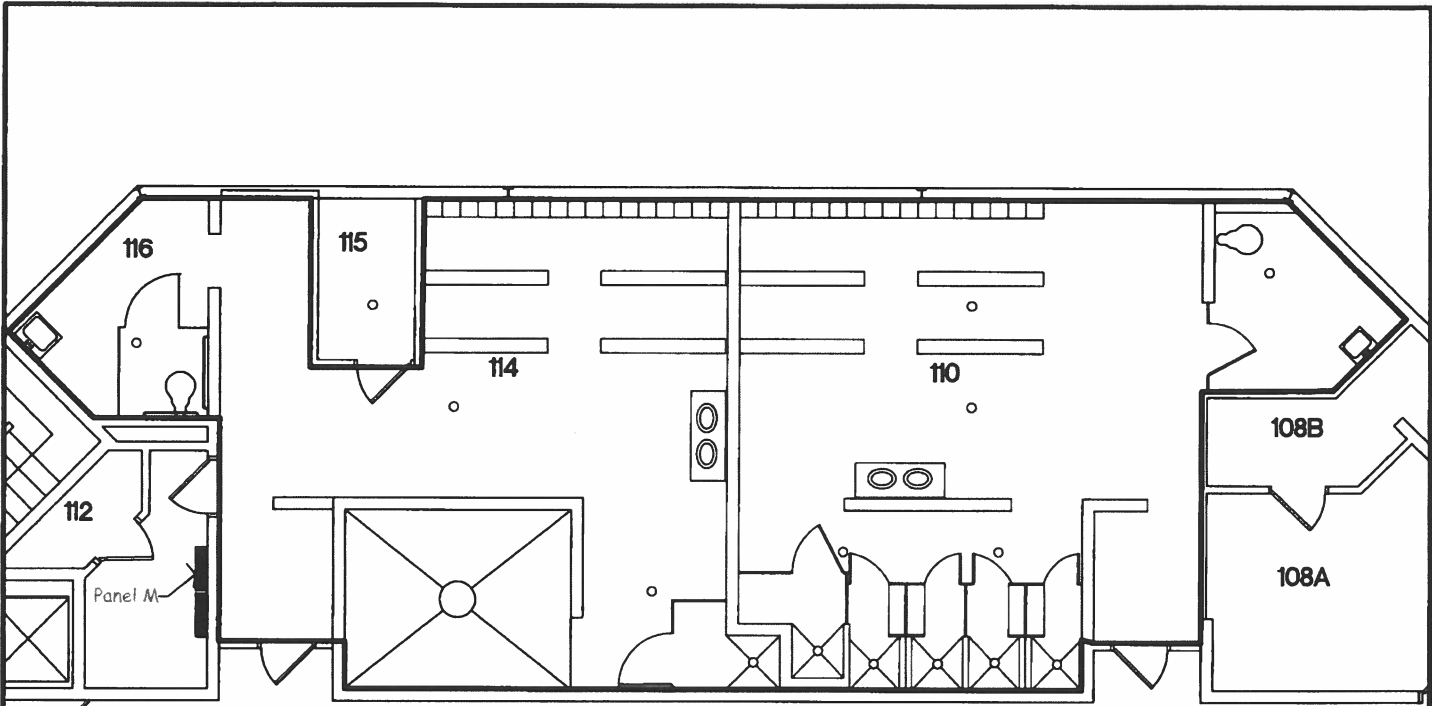
**Tenant:**

**Urbana Park District**

**By:** \_\_\_\_\_  
**Timothy Bartlett**  
**Executive Director**

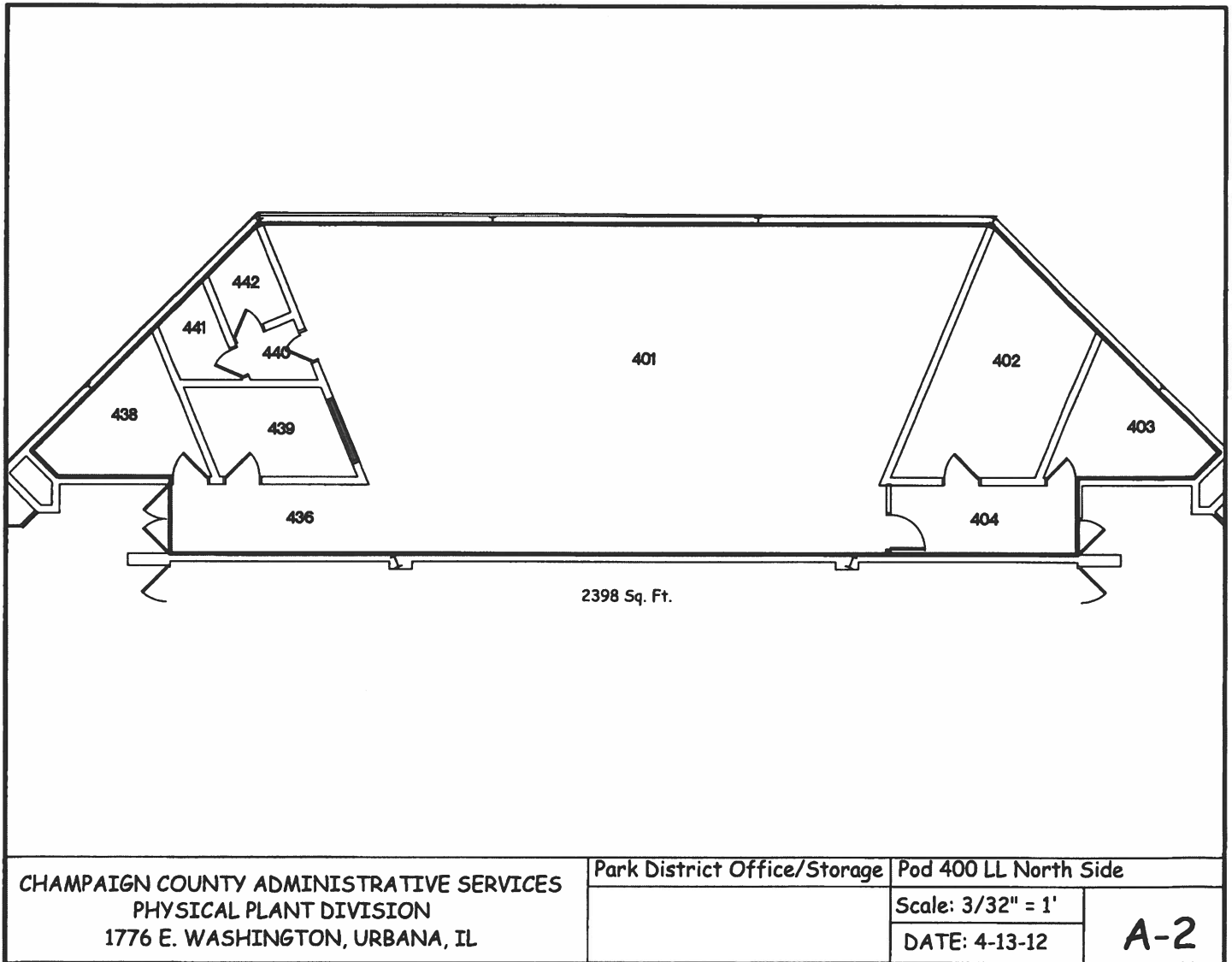
**Date:** \_\_\_\_\_

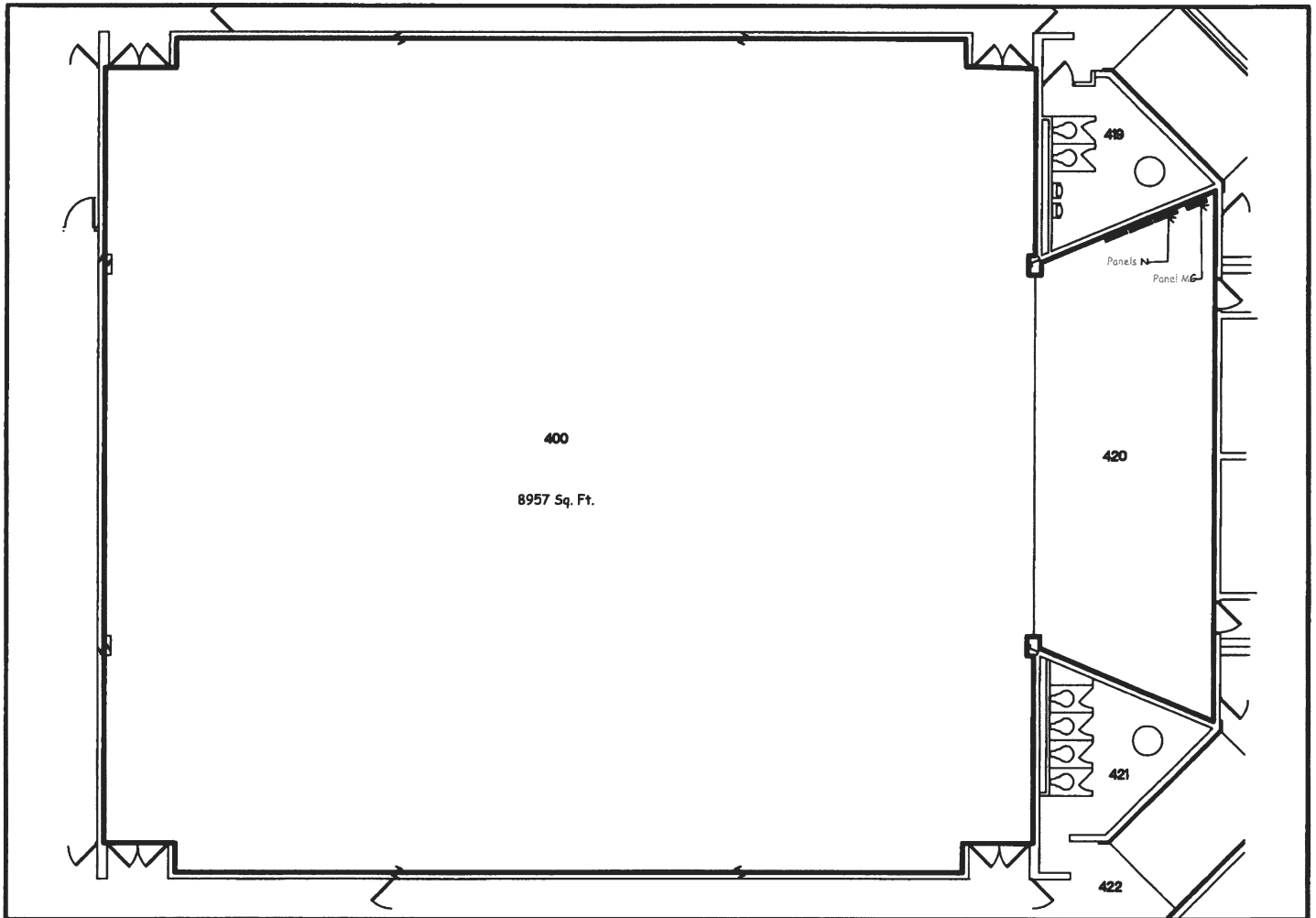
**ATTEST:** \_\_\_\_\_



1602 Sq. Ft.

CHAMPAIGN COUNTY ADMINISTRATIVE SERVICES PHYSICAL PLANT DIVISION 1776 E. WASHINGTON, URBANA, IL	Park District Locker Rms.	Pod 400 LL East Side	<b>A-1</b>
		Scale: 1/8" = 1' DATE: 4-13-12	





CHAMPAIGN COUNTY ADMINISTRATIVE SERVICES PHYSICAL PLANT DIVISION 1776 E. WASHINGTON, URBANA, IL	Park District Gym	Pod 400 Gym	<b>A-3</b>
		Scale: NTS DATE: 4-13-12	

EXISTING CHAMPAIGN COUNTY YOUTH DETENTION CENTER

236,530 sq ft

CHAMPAIGN COUNTY NURSING HOME

514005 sq ft

1905 OFFICE

5000 sq ft

5000 sq ft

Main Building

CHAMPAIGN COUNTY HUMANE SOCIETY

NEW CHAMPAIGN COUNTY YOUTH DETENTION CENTER

APPENDIX B



Indicates designated areas

CHAMPAIGN COUNTY JAIL

Fields

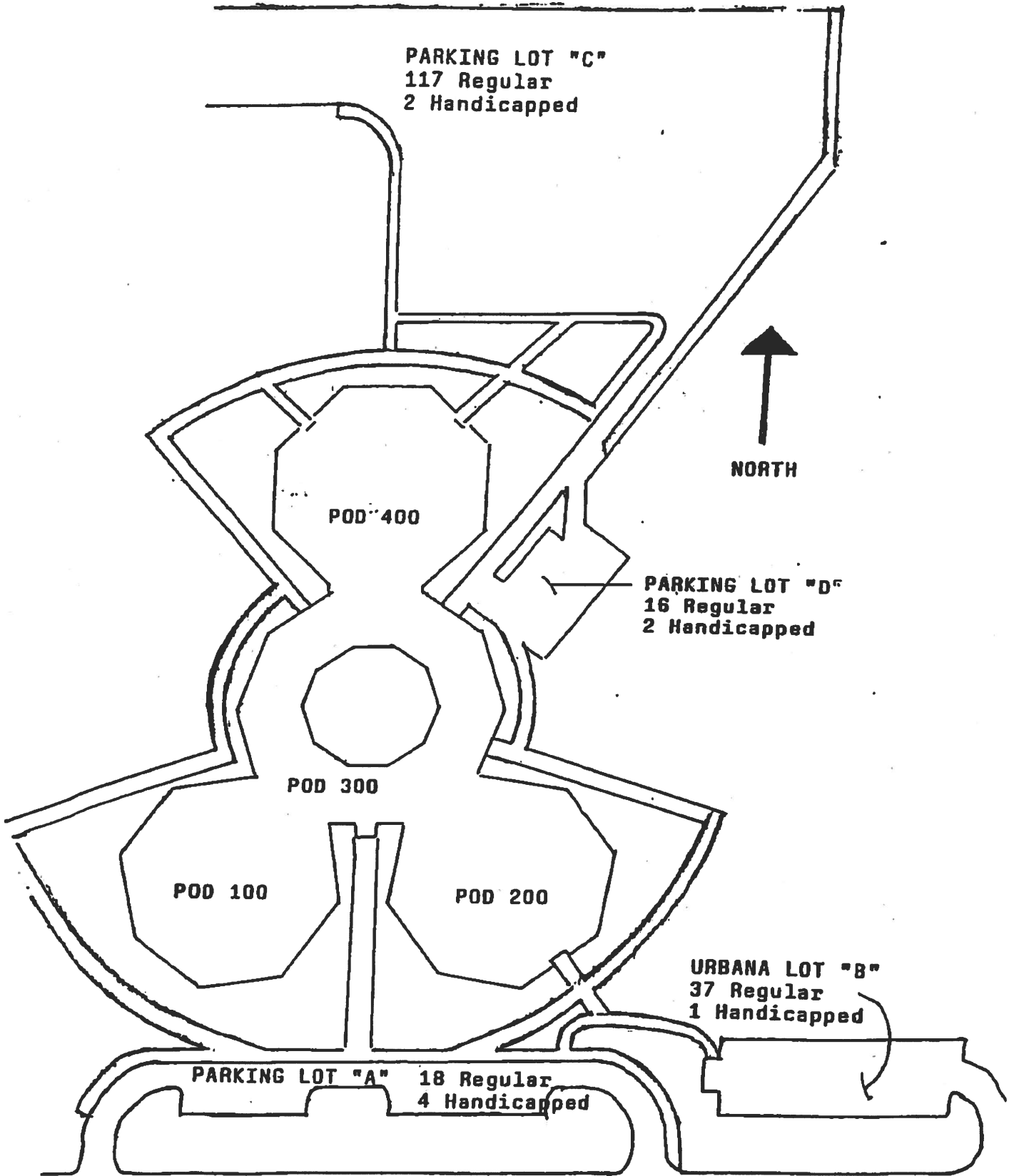
BROOKS ADMINISTRATION CENTER

145,815 sq ft

87,000 sq ft

726,990 sq ft

APPENDIX C



Champaign County Administrative Services  
Physical Plant







IN HONOR OF THE CHAMPAIGN COUNTY  
VETERANS WHO SERVED IN WORLD WAR II

*"Veterans know better than anyone else the price of freedom, for they've suffered the scars of war.  
We can offer them no better tribute than to protect what they have won for us".*

-President Ronald Reagan

This plaque created by donations from mothers and wives that had to send their loved ones off to war.







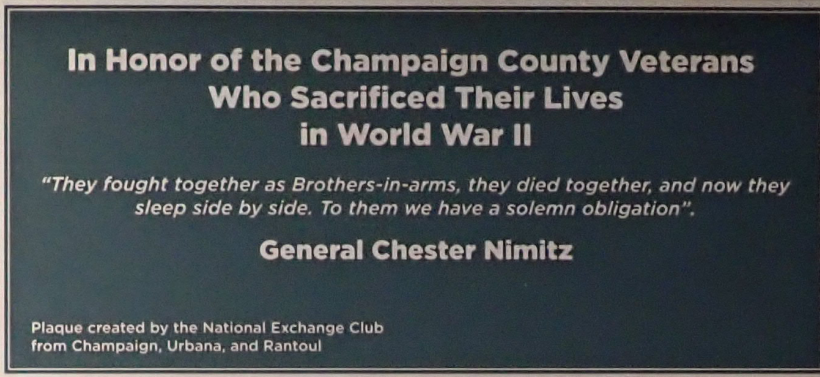
**In Honor of the Champaign County Veterans  
Who Sacrificed Their Lives  
in World War II**

*"They fought together as Brothers-in-arms, they died together, and now they  
sleep side by side. To them we have a solemn obligation".*

**General Chester Nimitz**

Plaque created by the National Exchange Club  
from Champaign, Urbana, and Rantoul

Elmer W. Adams	Glenn L. Brown	Carl W. Cook	Ralph A. Dorn	John E. Gillan
Orval Anderson	William L. Bryant	Doris F. Cooper	Alfred M. Dornell	Walter L. Glass
Leola P. Alban	Donald A. Buck	Harold E. Corby	Stanley E. Echols	Lewis Glover
Leo J. Alton	Thomas E. Cook	Edward J. Corman, Jr.	Maurice P. Ellis	Allen B. Goyne, Jr.
W.O. Ayle	Thomas H. Burch	James H. Cornell	Edward E. Eoff	Haye A. Goldenstein
Robert M. Bahr	Ellen C. Bardsley	John P. Coats	John L. Ernst	Paul F. Graham
Ralph D. Alwood	Frank M. Burt	John P. Crandall	Harlan L. Ewalt	Robert D. Grant
Gregory W. Sullivan	Travis E. Batts	Paul C. Crane	Robert L. Estoppy	Steven Graves
Sam J. Ayers	William O. Fyrd	Edward W. Cram	Donald L. Evans	William J. Gray
William M. Ballard	Francis W. Campbell	Harry L. Curtis, Jr.	Harold L. Evans	Arthur L. Gregerson
Walter Bough	Cyril E. Carmichael	Donald M. Dale	Robert J. Foster	Paul H. Griffin
Justin B. Best	Wayne E. Dawson	John F. Davidson	Glen A. Fladinder	Robert F. Green
Harold R. Bedford	Donald J. Chaffar	Dwight G. Davis	Robert A. Fisher	William G. Grocho
Ervin Bloom	Leslie C. Childress, Jr.	Ralph R. Davis	Edward D. Foley	Eugene W. Grotfield
Richard L. Blue	Carl E. Christensen	Rex A. Davis	Donald W. Fower	William L. Grove
William C. Boedeker	Harry E. Clabaugh	George B. Deering	Harold G. Franklin	Ronald L. Gundersen
Ernest S. Bolas	Kenneth J. Clark	Everett H. Dietrich	Galen Frazer	Arnold J. Gunter
A. J. Buntan	Russell L. Clark	Roger M. Gillman	Fanny O. Foyea	Edgar E. Goffin, Jr.
Steno A. Bragulat	Kenneth C. Clawson	Wayne C. Dinsley	James Gagliano	William E. Hall
Marshall F. Brown	Winford F. Clair	Elmer A. Dixon	Theodore R. Gursl	Jack Hamilton
Steven E. Brown	Clarence S. Collier	William E. Driscoll	Albert L. Gentile	Howland J. Hamlin
Dorland B. Brumfield	Allen H. Conlay	Robert E. Duffield	Charles L. Gatman	Noel L. Hamlin
Harold B. Geyer	Byron E. Williams	Ivan J. Williamson	Robert A. Wilson	Walter W. Winkler



Glenn F. Moorhead	Dwight P. Perry	Earl Roberts	John B. Steiner	William F. Turner
Thomas H. Moran	Richard E. Peters	James R. Roberts	Russell A. Shover	Robert T. Tarr
Ivan E. Morley, Jr.	Robert L. Peterson	Don E. Robinson	Walter H. Stoltz	Wesley W. Tschirch
Richard W. Morgan	John F. Peckbridge	Harold A. Roark	William L. Rayson	David J. Toman
Robert W. Morrow	Leslie R. Pettijohn	William F. Rogers	David L. Smith	Arthur B. Tress
Terrence J. Mortenson	Albert D. Photo	Charles A. Rothberg	Donald W. South	Frank A. Tye, Jr.
Thomas B. Moundress	Raymond Platteau	Ray L. Ross	James B. Smith	Walter H. Tynes
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# In Honor of the Champaign County Veterans Who Sacrificed Their Lives in World War II

*"They fought together as Brothers-in-arms, they died together, and now they sleep side by side. To them we have a solemn obligation".*

**General Chester Nimitz**

Plaque created by the National Exchange Club  
from Champaign, Urbana, and Rantoul

Eugene F.  
Hammond

Lloyd L.  
Hitchens

Ozzle A.  
Johnson

Jack W.  
Kortkamp

William S.  
Latimer

John R.  
Lewis

Harold F.  
Matsler

Wayne J.  
Hanks

William H.  
Holthoff

William C.  
Johnson

Arthur O.  
Koss

Gayle  
Laymon

Arthur  
Ligon

Jack W.  
McCullough

Noel L.  
Hannah

Earl A.  
Houser

Eugene H.  
Kannapel

Adolph J.  
Kraus

Thomas H.  
Leeper

Russell B.  
Lindley

Glenn D.  
McElroy

Terry N.

John S.

Robert T.

William H.

Jasper L.

Ross J.