UNIVERSITY OF KENTUCKY

Purchasing Division

Request for Proposal
UK-2321-23
Proposal Due Date – 03/07/2023

Memorial Coliseum
Miscellaneous Building Systems Equipment
Project# 2590.13

UNIVERSITY OF KENTUCKY
Purchasing Division

REQUEST FOR PROPOSAL (RFP)

ATTENTION: This is not an order. Read all instructions, terms and conditions carefully.

PROPOSAL NO.:	**UK-2321-23**	**RETURN ORIGINAL COPY OF PROPOSAL TO:**
Issue Date:	**02/13/2023**	**UNIVERSITY OF KENTUCKY**
	Memorial Coliseum Misc. Building Systems	**PURCHASING DIVISION**
Title:	**Equipment**	**411 S LIMESTONE**
Purchasing Officer:	**Ken Scott**	**ROOM 322 PETERSON SERVICE BLDG.**
Phone/Email:	**859-257-9102/Kenneth.Scott@uky.edu**	**LEXINGTON, KY 40506-0005**

IMPORTANT: PROPOSALS MUST BE RECEIVED BY: 03/07/2023 3 P.M. LEXINGTON, KY TIME.

NOTICE OF REQUIREMENTS

1. The University's General Terms and Conditions and Instructions to Bidders, viewable at www.uky.edu/Purchasing/terms.htm, apply to this RFP. When the RFP includes construction services, the University's General Conditions for Construction and Instructions to Bidders, viewable at www.uky.edu/Purchasing/ccphome.htm, apply to the RFP.
2. Contracts resulting from this RFP must be governed by and in accordance with the laws of the Commonwealth of Kentucky.
3. Any agreement or collusion among offerors or prospective offerors, which restrains, tends to restrain, or is reasonably calculated to restrain competition by agreement to bid at a fixed price or to refrain from offering, or otherwise, is prohibited.
4. Any person who violates any provisions of KRS 45A.325 shall be guilty of a felony and shall be punished by a fine of not less than five thousand dollars nor more than ten thousand dollars, or be imprisoned not less than one year nor more than five years, or both such fine and imprisonment. Any firm, corporation, or association who violates any of the provisions of KRS 45A.325 shall, upon conviction, be fined not less than ten thousand dollars or more than twenty thousand dollars.

AUTHENTICATION OF BID AND STATEMENT OF NON-COLLUSION AND NON-CONFLICT OF INTEREST

I hereby swear (or affirm) under the penalty for false swearing as provided by KRS 523.040:

1. That I am the offeror (if the offeror is an individual), a partner, (if the offeror is a partnership), or an officer or employee of the bidding corporation having authority to sign on its behalf (if the offeror is a corporation);
2. That the attached proposal has been arrived at by the offeror independently and has been submitted without collusion with, and without any agreement, understanding or planned common course of action with, any other Contractor of materials, supplies, equipment or services described in the RFP, designed to limit independent bidding or competition;
3. That the contents of the proposal have not been communicated by the offeror or its employees or agents to any person not an employee or agent of the offeror or its surety on any bond furnished with the proposal and will not be communicated to any such person prior to the official closing of the RFP:
4. That the offeror is legally entitled to enter into contracts with the University of Kentucky and is not in violation of any prohibited conflict of interest, including, but not limited to, those prohibited by the provisions of KRS 45A.330 to .340, and164.390;
5. That the offeror, and its affiliates, are duly registered with the Kentucky Department of Revenue to collect and remit the sale and use tax imposed by Chapter 139 to the extent required by Kentucky law and will remain registered for the duration of any contract award;
6. That I have fully informed myself regarding the accuracy of the statement made above.

SWORN STATEMENT OF COMPLIANCE WITH CAMPAIGN FINANCE LAWS

In accordance with KRS45A.110 (2), the undersigned hereby swears under penalty of perjury that he/she has not knowingly violated any provision of the campaign finance laws of the Commonwealth of Kentucky and that the award of a contract to a bidder will not violate any provision of the campaign finance laws of the Commonwealth of Kentucky.

CONTRACTOR REPORT OF PRIOR VIOLATIONS OF KRS CHAPTERS 136, 139, 141, 337, 338, 341 & 342

The contractor by signing and submitting a proposal agrees as required by 45A.485 to submit final determinations of any violations of the provisions of KRS Chapters 136, 139, 141, 337, 338, 341 and 342 that have occurred in the previous five (5) years prior to the award of a contract and agrees to remain in continuous compliance with the provisions of the statutes during the duration of any contract that may be established. Final determinations of violations of these statutes must be provided to the University by the successful contractor prior to the award of a contract.

CERTIFICATION OF NON-SEGREGATED FACILITIES

The contractor, by submitting a proposal, certifies that he/she is in compliance with the Code of Federal Regulations, No. 41 CFR 60-1.8(b) that prohibits the maintaining of segregated facilities.

SIGNATURE REQUIRED: This proposal cannot be considered valid unless signed and dated by an authorized agent of the offeror. Type or print the signatory's name, title, address, phone number and fax number in the spaces provided. Offers signed by an agent are to be accompanied by evidence of his/her authority unless such evidence has been previously furnished to the issuing office.

DELIVERY TIME:	**NAME OF COMPANY:**	**DUNS #**
PROPOSAL FIRM THROUGH:	**ADDRESS:**	**Phone/Fax:**
PAYMENT TERMS:	**CITY, STATE & ZIP CODE:**	**E-MAIL:**
SHIPPING TERMS: F. O. B. DESTINATION PREPAID AND ALLOWED	**TYPED OR PRINTED NAME:**	**WEB ADDRESS:**
FEDERAL EMPLOYER ID NO.:	**SIGNATURE:**	**DATE:**

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ATTACHMENTS:

- Attachment A_Financial Offer for UK-2321-23
- Attachment B_Project Schedule
- Attachment C_Site Logistics
- Attachment D_General Terms and Conditions
- Attachment E_Switchgear Project Manual
- Attachment F_Medium Voltage Switchgear Project Manual
- Attachment G_Generator ATS Project Manual
- Attachment H_AHU Project Manual
- Attachment I_Variable Frequency Drives Project Manual

1.0 DEFINITIONS

The term "addenda" means written or graphic instructions issued by the University of Kentucky prior to the receipt of proposals that modify or interpret the RFP documents by additions, deletions, clarifications and/or corrections.

The term "competitive negotiations" means the method authorized in the Kentucky Revised Statutes, Chapter 45A.085.

The terms "offer" or “proposal” mean the offeror’s/offerors’ response to this RFP.

The term "offeror" means the entity or contractor group submitting the proposal.

The term "contractor" means the entity receiving a contract award.

The term "purchasing agency" means the University of Kentucky, Purchasing Division, Room 322 Peterson Service Building, Lexington, KY 40506-0005.

The term "purchasing official" means the University of Kentucky’s appointed contracting representative.

The term "responsible offeror" means a person, company or corporation that has the capability in all respects to perform fully the contract requirements and the integrity and reliability that will assure good faith performance. In determining whether an offeror is responsible, the University may evaluate various factors including (but not limited to): financial resources; experience; organization; technical qualifications; available resources; record of performance; integrity; judgment; ability to perform successfully under the terms and conditions of the contract; adversarial relationship between the offeror and the University that is so serious and compelling that it may negatively impact the work performed under this RFP; or any other cause determined to be so serious and compelling as to affect the responsibility of the offeror.

The term "solicitation" means RFP.

The term "University" means University of Kentucky.

2.0 GENERAL OVERVIEW

2.1 Intent and Scope

This Request for Proposal (RFP) is issued to solicit proposals from qualified, experienced, financially sound, and responsible firms to provide the following equipment for the UK Memorial Coliseum in Lexington, Kentucky:

Equipment Package 1 - Switchgear
Equipment Package 2 - Medium Voltage Switchgear
Equipment Package 3 - Generator ATS
Equipment Package 4 – AHU
Equipment Package 5 – Variable Frequency Drives

The scope of work of this Project consists of the supply and warranting of all materials and products as herein specified in this RFP and Attachments. The installation labor will be included in a future bid package – This package is for materials only.

The selected Offerors will be required to:

- Provide full submittal documentation prior to releasing the order.
    - The design shall comply with all applicable codes, Owners standards http://www.uky.edu/Services/CPMD/ukstandards/Divisions/Master.html, rules, and regulations.
- Provide a single point of contact during the warranty period for all repairs. This single point of contact will have full responsibility for ensuring repairs are completed.
- After the warranty period has expired the Offeror must offer a maintenance contract on the system with a single point-of-contact for all repairs.

2.2 Background Information

Situated along Euclid Avenue on the University of Kentucky campus, Memorial Coliseum was completed in 1950 at a cost of approximately $4 million. The building serves as a memorial to the more than 10,000 Kentuckians who lost their lives in World War II and the Korean conflict. The Coliseum covers an entire city block and has as much space as a seven-story office building. In 1990, a $1 million renovation project added a state-of-the-art weight training facility, new basketball and athletics administration offices, players' lounges, and a team meeting room. As a result of the renovation, the seating capacity was reduced from 11,500 to 8,500. The building also houses UK's Center for Academic and Tutorial Services (CATS), a $2.4 million facility which opened in 1998. Further enhancements were made to the Coliseum when a new video board and scoreboard were installed in 2007 and a sound system was added in 2008.

From professional tennis exhibitions featuring the likes of Jim Courier and John McEnroe to the annual commencement ceremonies, Memorial Coliseum has played host to just about every type of event imaginable.

2.3 University Information

Since his arrival, President Eli Capilouto has set forth an ambitious agenda to extend and enhance our role as Kentucky's land-grant and flagship research university. By focusing on infrastructure growth and improvement; creating opportunities for innovative teaching, learning, and academic excellence; fostering a robust research and creative scholarship enterprise; providing life-saving subspecialty care; empowering communities through service and outreach; and encouraging a transparent and shared dialogue about institutional priorities; the University of Kentucky will ensure a new century of promise for the people we impact.

Founded in 1865 as a land-grant institution adjacent to downtown Lexington, UK is nestled in the scenic heart of the beautiful Bluegrass Region of Kentucky. From its early beginnings, with only 190 students and 10 professors, UK's campus now covers more than 918 acres and is home to more than 30,000 students and approximately 14,500 employees, including more than 2,300 full-time faculty. UK is one of a small number of universities in the United States that has programs in agriculture, engineering, a full complement of health colleges including medicine and pharmacy, law and fine arts on a single campus, leading to groundbreaking discoveries and unique interdisciplinary collaboration. The state's flagship university consists of 17 academic and professional colleges where students can choose from more than 200 majors and degree programs at the undergraduate and graduate levels. The colleges are Agriculture, Food and Environment; Arts and Sciences; Business and Economics; Communication and Information; Dentistry; Design; Education; Engineering; Fine Arts; Graduate School; Health Sciences; Law; Medicine; Nursing; Pharmacy; Public Health; and Social Work. These colleges are supported by a modern research library system.

Research at the University of Kentucky is a dynamic enterprise encompassing both traditional scholarship and emerging technologies, and UK's research faculty, staff and students are establishing UK as one of the nation's most prolific public research universities. UK's research enterprise attracted $285 million in research grants and contracts from out-of-state sources, which generated a $580 million impact on the Kentucky economy. Included in this portfolio is $153 million in federal awards from the National Institutes of Health, non-NIH grants from the Department Health and Human Services, the National Science Foundation, Department of Energy, Department of Agriculture and NASA, among others. The National Science Foundation ranks UK's research enterprise 44th among public institutions.

With more than 50 research centers and institutes, UK researchers are discovering new knowledge, providing a rich training ground for current students and the next generation of researchers, and advancing the economic growth of the Commonwealth of Kentucky. Several centers excel in the services offered to the public. The Gluck Equine Research Center is one of only three facilities of its kind in the world, conducting research in equine diseases.

The Center for Applied Energy Research is pursuing groundbreaking discovery across the energy disciplines. CAER staff are pioneering new ways to sustainably utilize Kentucky natural resources through carbon-capture algae technology, biomass/coal to liquid products and the opening of UK's first LEED-certified research lab to support the development of Kentucky's growing alternative energy industry.

Among the brightest examples of UK's investment in transformative research is the Markey Cancer Center. As a center of excellence and distinction at UK, Markey's robust research and clinical enterprise is the cornerstone of our commitment to Kentucky – fundamental to our success in uplifting lives through our endeavors and improving the general health and welfare of our state – burdened by the nation's highest rate of cancer deaths per 100,000 people. In 2013, Markey earned the prestigious National Cancer Institute-designation (NCI) – one of 68 nationally and the only one in Kentucky.

The University of Kentucky was awarded a $20 million Clinical Translational Sciences Award (CTSA) from the National Institutes of Health (NIH). As one of only 60 institutions with this research distinction, UK was awarded the CTSA for its potential in moving research and discovery in the lab into practical field and community applications. The CTSA and NCI are part of a trifecta of federal research grants that includes an Alzheimer's Disease Center. UK is one of only 22 universities in the country to hold all three premier grants from NIH.

Established in 1957, the medical center at UK is one of the nation's finest academic medical centers and includes the University's clinical enterprise, UK HealthCare. The 569-bed UK Albert B. Chandler Hospital and Kentucky Children's Hospital, along with 256 beds at UK Good Samaritan Hospital, are supported by a growing faculty and staff providing the most advanced subspecialty care for the most critically injured and ill patients throughout the Commonwealth and beyond. Over the last several years, the number of patients served by the medical enterprise has increased from roughly 19,000 discharges to more than 36,000 discharges in 2014.

UK Chandler Hospital includes the only Level 1 Trauma Center for both adult and pediatric patients in Central and Eastern Kentucky. In addition, UK HealthCare recently opened one of the country's largest robotic hybrid operating rooms and the first of its kind in the region. While our new patient care pavilion is the leading healthcare facility for advanced medical procedures in the region, our talented physicians consult with and travel to our network of affiliate hospitals so Kentucky citizens can receive the best health care available close to their home and never need to leave the Bluegrass for complex subspecialty care.

UK's agenda remains committed to accelerating the University's movement toward academic excellence in all areas and gain worldwide recognition for its outstanding academic programs, its commitment to students, its investment in pioneering research and discovery, its success in building a diverse community and its engagement with the larger society. It is all part of the University's fulfillment of our promise to Kentucky to position our state as a leader in American prosperity.

SUSTAINABILITY

Sustainability is an institution-wide priority for the University of Kentucky. We strive to ensure that all activities are ecologically sound, socially just, and economically viable, and that they will continue to be so for future generations. This commitment also prioritizes the integration of these principles in curricula, research, athletics, health care, creative works, and outreach. This principled approach to operational practices and intellectual pursuits is intended to prepare students and empower the campus community to support sustainable development in the Commonwealth and beyond. The UK Sustainability Strategic Plan guides these efforts (https://www.uky.edu/sustainability/sustainability-strategic-plan).

2.4 Supplier Diversity and Procurement

The University of Kentucky is committed to serve as an advocate for diverse businesses in their efforts to conduct business. Diverse Business Enterprises (DBE) consist of minority, women, disabled, veteran and disabled veteran owned business firms that are at least fifty-one percent owned and operated by an individual(s) of the aforementioned categories. Also included in this category are disabled business enterprises and non-profit work centers for the blind and severely disabled.

The University is committed to increasing the amount of goods and services acquired from businesses owned and controlled by diverse persons to 10% of all procurement expenditures. The University expects its suppliers to support and assist in this effort.

Among the University's goals for DBE participation in procurement are:

- To ensure the absence of barriers that reduce the participation of diverse suppliers
- Educate vendors on "how to" do business with the University
- Support diverse vendors seeking to do business with the University in the areas of goods, services, construction, and other areas of procurement
- Encourage participation of qualified diverse vendors by directing them to agencies that can benefit from their product or service
- Provide resources for diverse vendors
- Sponsor events to assist diverse vendors in becoming active, responsible, and responsive participants in the University's purchasing opportunities

For additional information regarding how diverse suppliers may participate in this Request for Proposal, submit any questions to the Purchasing Officer as indicated in Section 3.2 by the Deadline for Written Questions date.

3.0 PROPOSAL REQUIREMENTS

3.1 Key Event Dates

Release of RFP	02/13/2023
Pre-Proposal Conference (Optional)	3 P.M. Lexington, KY Time on 02/22/2023
Deadline for Written Questions	1 P.M. Lexington, KY Time on 02/24/2023
RFP Proposals Due	3 P.M. Lexington, KY Time on 03/07/2023

3.2 Offeror Communication

To ensure that RFP documentation and subsequent information (modifications, clarifications, addenda, Written Questions and Answers, etc.) are directed to the appropriate persons within the offeror's firm, each offeror who intends to participate in this RFP is to provide the following information to the purchasing officer. Prompt, thorough compliance is in the best interest of the offeror. Failure to comply may result in incomplete or delayed communication of addenda or other vital information. Contact information is the responsibility of the offeror. Without the prompt information, any communication shortfall shall reside with the offeror.

- Name of primary contact
- Mailing address of primary contact
- Telephone number of primary contact
- Fax number of primary contact
- E-mail address of primary contact
- Additional contact persons with same information provided as primary contact

This information shall be transmitted via fax or e-mail to:

Ken Scott
Purchasing Division
University of Kentucky
322 Peterson Service Building
Lexington, KY 40506-0005
Phone: (859) 257-9102
Fax: (859) 257-1951
E-mail: Kenneth.Scott@uky.edu

All communication with the University regarding this RFP shall only be directed to the purchasing officer listed above.

3.3 Pre-Proposal Conference

The Pre-Proposal Conference will be held Wednesday - February 22, 2023 at 3:00 PM via ZOOM – https://uky.zoom.us/j/89142040711.

Oral answers given at the conference are not binding. Offerors are encouraged to submit written questions after the Conference by the date listed in Section 3.1, Written Questions Phase 1, of this RFP. The questions and answers will be made part of the RFP and may become part of the contract with the successful Offeror.

3.4 Offeror Presentations

All offerors whose proposals are judged acceptable for award may be required to make a presentation to the evaluation committee.

3.5 Preparation of Offers

The offeror is expected to follow all specifications, terms, conditions and instructions in this RFP.

The offeror will furnish all information required by this solicitation.

Proposals should be prepared simply and economically, providing a description of the offeror's capabilities to satisfy the requirements of the solicitation. Emphasis should be on completeness and clarity of content. All documentation submitted with the proposal should be bound in the single volume except as otherwise specified.

Include in your proposal all relevant and important information which will help the selection committee evaluate your firm for this project. UK reserves the right to make a selection from proposals without conducting interviews.

An electronic version of the RFP, in .PDF format only, is available through the University of Kentucky Purchasing Division website at: https://purchasing.uky.edu/bid-and-proposal-opportunities.

3.6 Proposed Deviations from the RFP

The stated requirements appearing elsewhere in this RFP shall become a part of the terms and conditions of any resulting contract. Any deviations therefrom must be specifically defined in accordance with the transmittal letter, Section 4.3 (d). If accepted by the University, the deviations shall become part of the contract, but such deviations must not be in conflict with the basic nature of this RFP.

Note: Offerors shall not submit their standard terms and conditions as exceptions to the University's General Terms and Conditions. Each exception to the University's General Terms and Conditions shall be individually addressed.

3.7 Proposal Submission and Deadline

Offeror must provide the following materials, **FOR EACH EQUIPMENT PACKAGE PROPOSAL**, by 3 p.m. (Lexington, KY time) on the date specified in Section 3.1 and addressed to the purchasing officer listed in Section 3.2:

- One (1) electronic copy of the Technical and Financial Proposal in PDF format, as separate files, provided on a USB Drive. The Financial proposal should be clearly identifiable by the file name.

Note: Proposals received after the closing date and time will not be considered. In addition, proposals received via fax or e-mail are not acceptable.

The University of Kentucky accepts deliveries of RFPs Monday through Friday from 8 a.m. to 5 p.m. Lexington, KY time. However, RFPs must be received by 3 p.m. Lexington, KY time on the date specified on the RFP in order to be considered.

Proposals shall be enclosed in sealed envelopes to the above referenced address and shall show on the face of the envelope: the closing time and date specified, the solicitation number and the name and address of the offeror. The technical proposal shall be submitted in a sealed envelope and the financial proposal shall be submitted in a sealed envelope under separate cover. Both sealed envelopes shall have identical information on the cover, with the addition that one will state "Technical Information," and the other, "Financial Proposal."

Note: In accordance with the Kentucky Revised Statute 45A.085, there will be no public opening.

3.8 Modification or Withdrawal of Offer

An offer and/or modification of offer received at the office designated in the solicitation after the exact hour and date specified for receipt will not be considered.

An offer may be modified or withdrawn by written notice before the exact hour and date specified for receipt of offers. An offer also may be withdrawn in person by an offeror or an authorized representative, provided the identity of the person is made known and the person signs a receipt for the offer, but only if the withdrawal is made prior to the exact hour and date set for receipt of offers.

3.9 Acceptance or Rejection and Award of Proposal

The University reserves the right to accept or reject any or all proposals (or parts of proposals), to waive any informalities or technicalities, to clarify any ambiguities in proposals and (unless otherwise specified) to accept any item in the proposal. In case of error in extension or prices or other errors in calculation, the unit price shall govern. Further, the University reserves the right to make a single award, split awards, multiple awards or no award, whichever is in the best interest of the University.

3.10 Rejection

Grounds for the rejection of proposals include (but shall not be limited to):

- Failure of a proposal to conform to the essential requirements of the RFP.
- Imposition of conditions that would significantly modify the terms and conditions of the solicitation or limit the offeror's liability to the University on the contract awarded on the basis of such solicitation.
- Failure of the offeror to sign the University RFP. This includes the Authentication of Proposal and Statement of Non-Collusion and Non-Conflict of Interest statements.
- Receipt of proposal after the closing date and time specified in the RFP.

3.11 Addenda

Any addenda or instructions issued by the purchasing agency prior to the time for receiving proposals shall become a part of this RFP. Such addenda shall be acknowledged in the proposal. No instructions or changes shall be binding unless documented by a proper and duly issued addendum.

3.12 Disclosure of Offeror's Response

The RFP specifies the format, required information and general content of proposals submitted in response to this RFP. The purchasing agency will not disclose any portions of the proposals prior to contract award to anyone outside the Purchasing Division, the University's administrative staff, representatives of the state or federal government (if required) and the members of the committee evaluating the proposals. After a contract is awarded in whole or in part, the University shall have the right to duplicate, use or disclose all proposal data submitted by offerors in response to this RFP as a matter of public record.

Any submitted proposal shall remain valid six (6) months after the proposal due date.

The University shall have the right to use all system ideas, or adaptations of those ideas, contained in any proposal received in response to this RFP. Selection or rejection of the proposal will not affect this right.

3.13 Restrictions on Communications with University Staff

From the issue date of this RFP until a contractor is selected and a contract award is made, offerors are not allowed to communicate about the subject of the RFP with any University administrator, faculty, staff or members of the board of trustees except: the purchasing office representative, any University purchasing official representing the University administration, others authorized in writing by the purchasing office and University representatives during offeror presentations. If violation of this provision occurs, the University reserves the right to reject the offeror's proposal.

3.14 Cost of Preparing Proposal

Costs for developing the proposals and any subsequent activities prior to contract award are solely the responsibility of the offerors. The University will provide no reimbursement for such costs.

3.15 Disposition of Proposals

All proposals become the property of the University. The successful proposal will be incorporated into the resulting contract by reference.

3.16 Alternate Proposals

Offerors may submit alternate proposals. If more than one proposal is submitted, all must be complete (separate) and comply with the instructions set forth within this document. Each proposal will be evaluated on its own merits.

3.17 Questions

All questions should be submitted by either fax or e-mail to the purchasing officer listed in Section 3.2 no later than the date listed in Section 3.1.

3.18 Section Titles in the RFP

Section titles used herein are for the purpose of facilitating ease of reference only and shall not be construed to infer the construction of contractual language.

3.19 No Contingent Fees

No person or selling agency shall be employed or retained or given anything of monetary value to solicit or secure this contract, except bona fide employees of the offeror or bona fide established commercial or selling agencies maintained by the offeror for the purpose of securing business. For breach or violation of this provision, the University shall have the right to reject the proposal, annul the contract without liability, or, at its discretion, deduct from the contract price or otherwise recover the full amount of such commission, percentage, brokerage or contingent fee or other benefit.

3.20 Proposal Addenda and Rules for Withdrawal

Prior to the date specified for receipt of offers, a submitted proposal may be withdrawn by submitting a written request for its withdrawal to the University purchasing office, signed by the offeror. Unless requested by the University, the University will not accept revisions or alterations to proposals after the proposal due date.

3.21 Requirement To Perform Vendor Onboarding and Registration

As a condition of award, and for any renewals performed during the life of the contract, successful Contractor agrees to register their company with PaymentWorks, Inc., the University's vendor onboarding application. Registration information will be provided by the Purchasing Division as part of the award process. During the vendor registration process, successful Contractor agrees to provide any applicable information pertaining to diversity demographics for their company. Further, should any company or diversity information change during the life of the contract, successful Contractor agrees to update this information in PaymentWorks as applicable.

4.0 PROPOSAL FORMAT AND CONTENT

4.1 Proposal Information and Criteria

The following list specifies the items to be addressed in the proposal. Offerors should read it carefully and address it completely and in the order listed to facilitate the University's review of the proposal.

Proposals shall be organized into the sections identified below. The content of each section is detailed in the following pages. It is strongly suggested that offerors use the same numbers for the following content that are used in the RFP.

- Signed Authentication of Proposal and Statement of Non-Collusion and Non-Conflict of Interest Form
- Transmittal Letter
- Executive Summary and Proposal Overview
- Criteria 1 - Offeror Qualifications
- Criteria 2 - Services Defined
- Criteria 3 - Financial Proposal
- Criteria 4 - Evidence of Successful Performance and Delivery Schedule
- Criteria 5 - Other Additional Information

4.2 Signed Authentication of Proposal and Statements of Non-Collusion and Non-Conflict of Interest Form

The Offeror will sign and return the proposal cover sheet and print or type their name, firm, address, telephone number and date. The person signing the offer must initial erasures or other changes. An offer signed by an agent is to be accompanied by evidence of their authority unless such evidence has been previously furnished to the purchasing agency. The signer shall further certify that the proposal is made without collusion with any other person, persons, company or parties submitting a proposal; that it is in all respects fair and in good faith without collusion or fraud; and that the signer is authorized to bind the principal offeror.

4.3 Transmittal Letter

The Transmittal Letter accompanying the RFP shall be in the form of a standard business letter and shall be signed by an individual authorized to legally bind the offeror. It shall include:

- A statement referencing all addenda and written questions, the answers and any clarifications to this RFP issued by the University and received by the offeror (If no addenda have been received, a statement to that effect should be included.).
- A statement that the offeror's proposal shall remain valid for six (6) months after the closing date of the receipt of the proposals.
- A statement that the offeror will accept financial responsibility for all travel expenses incurred for oral presentations (if required) and candidate interviews.
- A statement that summarizes any deviations or exceptions to the RFP requirements and includes a detailed justification for the deviation or exception.
- A statement that identifies the confidential information as described in Section 6.23.

4.4 Executive Summary and Proposal Overview

The Executive Summary and Proposal Overview shall condense and highlight the contents of the technical proposal in such a way as to provide the evaluation committee with a broad understanding of the entire proposal.

As part of the Executive Summary and Proposal Overview, Offeror shall submit with their response a summarized profile describing the demographic nature of their company or organization:

1. When was your organization established and/or incorporated?
2. Indicate whether your organization is classified as local, regional, national, or international.
3. Describe the size of your company in terms of number of employees, gross sales, etc.
4. Is your company certified as small business, minority-owned, women-owned, veteran-owned, disabled-owned, or similar classification?
5. Include other demographic information that you feel may be applicable to the Request for Proposal submission.

6. Offeror shall describe in detail their company's commitment to diversity, equity, and inclusion. Information shall be provided as to the number of diverse individuals that the vendor employees as well as a description of vendors efforts to do business with Diverse Business Enterprises as they conduct their own business. In additional, please indicate the diversity nature of your company as well as ownership race/ethnicity.

Check One Only	Diverse Business Description (If Diverse Business, determine the classification that is the best description)	Internal Code
	Minority Owned (only)	10
	Veteran Owned and Small Business	100
	Minority and Woman and Small Business	110
	Minority and Woman and Veteran-Owned Business	120
	Minority and Veteran and Small Business	130
	Woman and Veteran and Small Business	140
	Minority and Woman and Veteran-Owned Small Business	150
	Woman Owned (only)	20
	Small Business (only)	30
	Veteran Owned (only)	40
	Minority and Woman Owned	50
	Minority and Small Business	60
	Minority and Veteran-Owned	70
	Woman Owned and Small Business	80
	Woman and Veteran-Owned	90
	Diversity not indicated	999

Race/Ethnicity	Check One
Asian	
Black/African American	
Hispanic or Latino	
Native American	
Native Hawaiian/Pacific Islander	
White	
Other	

4.5 Criteria 1 - Offeror Qualifications

The purpose of the Offeror Qualifications section is to determine the ability of the offeror to respond to this RFP. Offerors must describe and offer evidence of their ability to meet each of the qualifications listed below.

Our supply chains and business partnerships are an important aspect of this work. In your proposal, please (A) provide your company's mission and vision relative to sustainability, and (B) how your company, through services, products, and partnerships, will help the University of Kentucky advance specific elements of the Sustainability Strategic Plan.

4.6 Criteria 2 – Services Defined

1. The Offeror's ability to provide each of the services required, listed in Section 7.1.
2. The Offeror's tools and personnel available to support the scope of services.

4.7 Criteria 3 – Financial Proposal

The Financial Summary Form shall contain the complete financial offer made to the University using the format contained in Section 8.0. All financial information must be submitted in a sealed envelope under separate cover.

4.8 Criteria 4 – Evidence of Successful Performance and Delivery Schedule

1. Provide evidence of successful experience performing the services requested.
2. Provide production and delivery schedule.

4.9 Criteria 5 – Other Additional Information

The offeror may present any creative approaches that might be appropriate. The offeror may also provide supporting documentation that would be pertinent to this RFP.

Offeror shall describe in detail their company's commitment to diversity, equity and inclusion. Information shall be provided as to the number of diverse individuals that the vendor employees as well as a description of vendors efforts to do business with Diverse Business Enterprises as they conduct their own business.

5.0 EVALUATION CRITERIA PROCESS

A committee of University officials appointed by the Chief Procurement Officer will evaluate proposals and make a recommendation to the Chief Procurement Officer. The evaluation will be based upon the information provided in the proposal, additional information requested by the University for clarification, information obtained from references and independent sources and oral presentations (if requested).

The evaluation of responsive proposals shall then be completed by an evaluation team, which will determine the ranking of proposals. Proposals will be evaluated strictly in accordance with the requirements set forth in this solicitation, including any addenda that are issued. The University will award the contract to the responsible offeror whose proposal is determined to be the most advantageous to the University, taking into consideration the evaluation factors set forth in this RFP.

The evaluation of proposals will include consideration of responses to the list of criteria in Section 4.0. Offerors must specifically address all criteria in their response. Any deviations or exceptions to the specifications or requirements must be described and justified in a transmittal letter. Failure to list such exceptions or deviations in the transmittal letter may be considered sufficient reason to reject the proposal.

The relative importance of the criteria is defined below:

Primary Criteria

- Offeror Qualifications
- Services Defined
- Financial Proposal
- Evidence of Successful Performance and Delivery

Secondary Criteria

- Other Additional Services

The University will evaluate proposals as submitted and may not notify offerors of deficiencies in their responses.

Proposals must contain responses to each of the criteria, listed in Section 4 even if the offeror’s response cannot satisfy those criteria. A proposal may be rejected if it is conditional or incomplete in the judgment of the University.

6.0 SPECIAL CONDITIONS

6.1 Purchase Order

This Request for Proposals is to establish Purchase Orders for the custom equipment that will serve new construction at the University.

6.2 Effective Date

The effective date shall be the date the selected vendor receives purchase order.

6.3 Competitive Negotiation

It is the intent of the RFP to enter into competitive negotiation as authorized by KRS 45A.085.

The University will review all proposals properly submitted. However, the University reserves the right to request necessary modifications, reject all proposals, reject any proposal that does not meet mandatory requirement(s) or cancel this RFP, according to the best interests of the University.

Offeror(s) selected to participate in negotiations may be given an opportunity to submit a Best and Final Offer to the purchasing agency. All information-received prior to the cut-off time will be considered part of the offeror's Best and Final Offer.

The University also reserves the right to waive minor technicalities or irregularities in proposals providing such action is in the best interest of the University. Such waiver shall in no way modify the RFP requirements or excuse the offeror from full compliance with the RFP specifications and other contract requirements if the offeror is awarded the contract.

6.4 Appearance Before Committee

Any, all or no offerors may be requested to appear before the evaluation committee to explain their proposal and/or to respond to questions from the committee concerning the proposal. Offerors are prohibited from electronically recording these meetings. The committee reserves the right to request additional information.

6.5 Additions, Deletions or Contract Changes

The University reserves the right to add, delete, or change related items or services to the contract established from this RFP. No modification or change of any provision in the resulting contract shall be made unless such modification is mutually agreed to in writing by the contractor and the Chief Procurement Officer and incorporated as a written modification to the contract. Memoranda of understanding and correspondence shall not be interpreted as a modification to the contract.

6.6 Contractor Cooperation in Related Efforts

The University reserves the right to undertake or award other contracts for additional or related work to other entities. The contractor shall fully cooperate with such other contractors and University employees and carefully fit its work to such additional work. The contractor shall not commit or permit any act which will interfere with the performance of work by any other contractor or by University employees. This clause shall be included in the contracts of all contractors with whom this contractor will be required to cooperate. The University shall equitably enforce this clause to all contractors to prevent the imposition of unreasonable burdens on any contractor.

6.7 Entire Agreement

The RFP shall be incorporated into any resulting contract. The resulting contract, including the RFP and those portions of the offeror's response accepted by the University, shall be the entire agreement between the parties.

6.8 Governing Law

The contractor shall conform to and observe all laws, ordinances, rules and regulations of the United States of America, Commonwealth of Kentucky and all other local governments, public authorities, boards or offices relating to the property or the improvements upon same (or the use thereof) and will not permit the same to be used for any illegal or immoral purposes, business or occupation. The resulting contract shall be governed by Kentucky law and any claim relating to this contract shall only be brought in the Franklin Circuit Court in accordance with KRS 45A.245.

6.9 Kentucky's Personal Information Security and Breach Investigation Procedures and Practices Act

To the extent Company receives Personal Information as defined by and in accordance with Kentucky's Personal Information Security and Breach Investigation Procedures and Practices Act, KRS 61.931, 61.932 and 61.933 (the "Act"), Company shall secure and protect the Personal Information by, without limitation: (i) complying with all requirements applicable to non-affiliated third parties set forth in the Act; (ii) utilizing security and breach investigation procedures that are appropriate to the nature of the Personal Information disclosed, at least as stringent as University's and reasonably designed to protect the Personal Information from unauthorized access, use, modification, disclosure, manipulation, or destruction; (iii) notifying University of a security breach relating to Personal Information in the possession of Company or its agents or subcontractors within seventy-two (72) hours of discovery of an actual or suspected breach unless the exception set forth in KRS 61.932(2)(b)2 applies and Company abides by the requirements set forth in that exception; (iv) cooperating with University in complying with the response, mitigation, correction, investigation, and notification requirements of the Act , (v) paying all costs of notification, investigation and mitigation in the event of a security breach of Personal Information suffered by Company; and (vi) at University's discretion and direction, handling all administrative functions associated with notification, investigation and mitigation.

6.10 Termination for Convenience

The University of Kentucky, Purchasing Division, reserves the right to terminate the resulting contract without cause with a thirty (30) day written notice. Upon receipt by the contractor of a "notice of termination," the contractor shall discontinue all services with respect to the applicable contract. The cost of any agreed upon services provided by the contractor will be calculated at the agreed upon rate prior to a "notice of termination" and a fixed fee contract will be pro-rated (as appropriate).

6.11 Termination for Non-Performance

Default

The University may terminate the resulting contract for non-performance, as determined by the University, for such causes as:

- Failing to provide satisfactory quality of service, including, failure to maintain adequate personnel, whether arising from labor disputes, or otherwise any substantial change in ownership or proprietorship of the Contractor, which in the opinion of the University is not in its best interest, or failure to comply with the terms of this contract;

- Failing to keep or perform, within the time period set forth herein, or violation of, any of the covenants, conditions, provisions or agreements herein contained;

- Adjudicating as a voluntarily bankrupt, making a transfer in fraud of its creditors, filing a petition under any section from time to time, or under any similar law or statute of the United States or any state thereof, or if an order for relief shall be entered against the Contractor in any proceeding filed by or against contractor thereunder. In the event of any such involuntary bankruptcy proceeding being instituted against the Contractor, the fact of such an involuntary petition being filed shall not be considered an event of default until sixty (60) days after filing of said petition in order that Contractor might during that sixty (60) day period have the opportunity to seek dismissal of the involuntary petition or otherwise cure said potential default; or

- Making a general assignment for the benefit of its creditors, or taking the benefit of any insolvency act, or if a permanent receiver or trustee in bankruptcy shall be appointed for the Contractor.

Demand for Assurances

In the event the University has reason to believe Contractor will be unable to perform under the Contract, it may make a demand for reasonable assurances that Contractor will be able to timely perform all obligations under the Contract. If Contractor is unable to provide such adequate assurances, then such failure shall be an event of default and grounds for termination of the Contract.

Notification

The University will provide ten (10) calendar days written notice of default. Unless arrangements are made to correct the non-performance issues to the University's satisfaction within ten (10) calendar days, the University may terminate the contract by giving forty-five (45) days notice, by registered or certified mail, of its intent to cancel this contract.

6.12 Funding Out

The University may terminate this contract if funds are not appropriated or are not otherwise available for the purpose of making payments without incurring any obligation for payment after the date of termination, regardless of the terms of the contract. The University shall provide the contractor thirty (30) calendar days' written notice of termination under this provision.

6.13 Prime Contractor Responsibility

Any contracts that may result from the RFP shall specify that the contractor(s) is/are solely responsible for fulfillment of the contract with the University.

6.14 Assignment and Subcontracting

The Contractor(s) may not assign or delegate its rights and obligations under any contract in whole or in part without the prior written consent of the University. Any attempted assignment or subcontracting shall be void.

6.15 Permits, Licenses, Taxes

The contractor shall procure all necessary permits and licenses and abide by all applicable laws, regulations and ordinances of all federal, state and local governments in which work under this contract is performed.

The contractor must furnish certification of authority to conduct business in the Commonwealth of Kentucky as a condition of contract award. Such registration is obtained from the Secretary of State, who will also provide the certification thereof. However, the contractor need not be registered as a prerequisite for responding to the RFP.

The contractor shall pay any sales, use, personal property and other tax arising out of this contract and the transaction contemplated hereby. Any other taxes levied upon this contract, the transaction or the equipment or services delivered pursuant hereto shall be the responsibility of the contractor.

The contractor will be required to accept liability for payment of all payroll taxes or deductions required by local and federal law including (but not limited to) old age pension, social security or annuities.

6.16 Attorneys' Fees

In the event that either party deems it necessary to take legal action to enforce any provision of the contract and in the event that the University prevails, the contractor agrees to pay all expenses of such action including attorneys' fees and costs at all stages of litigation.

6.17 Royalties, Patents, Copyrights and Trademarks

The Contractor shall pay all applicable royalties and license fees. If a particular process, products or device is specified in the contract documents and it is known to be subject to patent rights or copyrights, the existence of such rights shall be disclosed in the contract documents and the Contractor is responsible for payment of all associated royalties. To the fullest extent permitted by law the Contractor shall indemnify, hold the University harmless, and defend all suits, claims, losses, damages or liability resulting from any infringement of patent, copyright, and trademark rights resulting from the incorporation in the Work or device specified in the Contract Documents.

Unless provided otherwise in the contract, the Contractor shall not use the University's name nor any of its trademarks or copyrights, although it may state that it has a Contract with the University.

6.18 Indemnification

The contractor shall indemnify, hold and save harmless the University, its affiliates and subsidiaries and their officers, agents and employees from losses, claims, suits, actions, expenses, damages, costs (including court costs and attorneys' fees of the University's attorneys), all liability of any nature or kind arising out of or relating to the Contractor's response to this RFP or its performance or failure to perform under the contract awarded from this RFP. This clause shall survive termination for as long as necessary to protect the University.

6.19 Insurance

The successful Contractor shall procure and maintain, at its expense, the following minimum insurance coverages insuring all services, work activities and obligations undertaken in this RFP for each Equipment Package. These insurance policies must be with insurers acceptable to the University.

COVERAGES	LIMITS
Workers' Compensation	Statutory Requirements (Kentucky)
Employer's Liability	$500,000/$500,000/$500,000
Commercial General Liability including operations/completed operations, products and contractual liability (including defense and investigation costs), and this contract	$100,000 each occurrence (BI & PD combined) $2,000,000 Products and Completed Operations Aggregate
Business Automobile Liability covering owned, leased, or non-owned autos	$1,000,000 each occurrence (BI & PD combined)

The successful contractor agrees to furnish Certificates of Insurance for the above-described coverages and limits to the University of Kentucky, Purchasing Division. The University, its trustees and employees must be added as additional insured on the Commercial General Liability policy with regard to the scope of this solicitation. Any deductibles or self-insured retention in the above-described policies must be paid and are the sole responsibility of the contractor. Coverage is to be primary and non-contributory with other coverage (if any) purchased by the University. All of these required policies must include a Waiver of Subrogation (except Workers' Compensation) in favor of the University, its trustees and employees.

6.20 Method of Award

It is the intent of the University to award a contract to the qualified offeror whose offer, conforming to the conditions and requirements of the RFP, is determined to be the most advantageous to the University, cost and other factors considered.

Notwithstanding the above, this RFP does not commit the University to award a contract from this solicitation. The University reserves the right to reject any or all offers and to waive formalities and minor irregularities in the proposal received.

6.21 Reciprocal Preference

In accordance with KRS 45A.494, a resident offeror of the Commonwealth of Kentucky shall be given a preference against a nonresident offeror. In evaluating proposals, the University will apply a reciprocal preference against an offeror submitting a proposal from a state that grants residency preference equal to the preference given by the state of the nonresident offeror. Residency and non-residency shall be defined in accordance with KRS 45A.494(2) and 45A.494(3), respectively. Any offeror claiming Kentucky residency status shall submit with its proposal a notarized affidavit affirming that it meets the criteria as set forth in the above reference statute.

6.22 NOT USED

6.23 Confidentiality

The University recognizes an offeror's possible interest in preserving selected information and data included in the proposal; however, the University must treat such information and data as required by the Kentucky Open Records Act, KRS 61.870, et seq.

Information areas which normally might be considered proprietary, and therefore confidential, shall be limited to individual personnel data, customer references, formulae and company financial audits which, if disclosed, would permit an unfair advantage to competitors. If a proposal contains information in these areas and the offeror declares them to be proprietary in nature and not available for public disclosure, the offeror shall declare in the Transmittal Letter the inclusion of proprietary information and shall noticeably label as confidential or proprietary each sheet containing such information. Proposals containing information declared by the offeror to be proprietary or confidential, either wholly or in part, outside the areas listed above may be deemed non-responsive and may be rejected.

The University's General Counsel shall review each offeror's information claimed to be confidential and, in consultation with the offeror (if needed), make a final determination as to whether or not the confidential or proprietary nature of the information or data complies with the Kentucky Open Records Act.

6.24 Conflict of Interest

This Request for Proposal and resulting Contract are subject to provisions of the Kentucky Revised Statutes regarding conflict of interest and the University of Kentucky's Ethical Principles and Code of Conduct (www.uky.edu/Legal/ethicscode.htm). When submitting and signing a proposal, an offeror is certifying that no actual, apparent or potential conflict of interest exists between the interests of the University and the interests of the offeror. A conflict of interest (whether contractual, financial, organizational or otherwise) exists when any individual, contractor or subcontractor has a direct or indirect interest because of a financial or pecuniary interest, gift or other activities or relationships with other persons (including business, familial or household relationships) and is thus unable to render or is impeded from rendering impartial assistance or advice, has impaired objectivity in performing the proposed work or has an unfair competitive advantage.

Questions concerning this section or interpretation of this section should be directed to the University purchasing officer identified in this RFP.

6.25 NOT USED

6.26 Copyright Ownership and Title to Designs and Copy

The contractor and University intend this RFP to result in a contract for services, and both consider the products and results of the services to be rendered by the contractor hereunder to be a work made for hire. The contractor acknowledges and agrees that the work and all rights therein, including (without limitation) copyright, belongs to and shall be the sole and exclusive property of the University. For any work that is not considered a work made for hire under applicable law, title and copyright ownership shall be assigned to the University.

Title to all dies, type, cuts, artwork, negatives, positives, color separations, progressive proofs, plates, copy and any other requirement not stated herein required for completion of the finished product for use in connection with any University job shall be the property of and owned by the University. Such items shall be returned to the appropriate department upon completion and/or delivery of work unless otherwise authorized by the University. In the event that time of return is not specified, the contractor shall return all such items to the appropriate University department within one week of delivery.

6.27 University Brand Standards

The contractor must adhere to all University of Kentucky Brand Standards. University Brand Standards are maintained by the University Public Relations Office (UKPR) and can be viewed at http://www.uky.edu/prmarketing/brand-standards. Non-adherence to the standards can have a penalty up to and including contract cancellation. Only the UKPR Director or designee can approve exceptions to the University standards.

Graphics standards for the UK HealthCare areas are governed by UK HealthCare Clinical Enterprise Graphic Standards, found at: https://ukhealthcare.uky.edu/staff/brand-strategy.

Contractor warrants that its products or services provided hereunder will be in compliance with all applicable Federal disabilities laws and regulations, including without limitation the accessibility requirements of Section 255 of the Federal Telecommunications Act of 1996 (47 U.S.C. § 255) and Section 508 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794d), and its implementing regulations set forth at Title 36, Code of Federal Regulations, Part 1194. For purposes of clarity, updated regulations under Section 508 standards now incorporate WCAG 2.0, and for purposes of this agreement WCAG 2.0 Level AA compliance is expressly included. Contractor agrees to promptly respond to, resolve and remediate any complaint regarding accessibility of products or services in a timely manner and provide an updated version to University at no cost. If deficiencies are identified, University reserves the right to request from Contractor, a timeline by which accessibility standards will be incorporated into the products or services provided by Contractor and shall provide such a timeline within a commercially reasonable duration of time. Failure to comply with these requirements shall constitute a material breach of this Agreement and shall be grounds for termination of this Agreement.

Where any customized web services are provided, Contractor represents that it has reviewed the University's Web Policy and all products or services will comply with its published standards.

Contractor will provide University with a current Voluntary Product Accessibility Template (VPAT) for any deliverable(s). If none is available, Vendor will provide sufficient information to reasonably assure the University that the products or services are fully compliant with current requirements.

6.28 NOT USED

6.29 NOT USED

6.30 Payment Terms

The University adheres to a strategic approach regarding payables management based on risk minimization, processing costs, and industry best practices. As such, suppliers and individuals doing business with the University will be paid based on the following protocol:

1. The University utilizes Payment Plus (e-payables) as its primary default form of payment. By enrolling in Payment Plus, suppliers can receive payments immediately (all invoices will be paid immediately upon confirmation of goods receipt and invoice). The process is electronic and the supplier receives real-time payment notices. Additional information regarding Payment Plus (and enrollment form) can be found at: https://www.uky.edu/ufs/payment-plus-supplier-enrollment-form.

2. Payments by check. Payment terms for check payments are Net-30.

3. Individuals receiving payments from the University that require ACH direct payments will only be processed under special circumstances as approved by the Controller's office. Payment terms for ACH are Net-40.

7.0 SCOPE OF SERVICES

7.1 Detailed Services Defined

With each equipment package, please provide extended warranty with description, cost and services provided under the warranty.

Equipment Package 1 - Switchgear:

1. Provide Secondary Unit Substations as defined by Spec Section 261116
2. Drawing reference – E310B and E600.
3. Coordinate with all mechanical, plumbing and electrical design documents to create a fully coordinated submittal for each component.
4. Provide delivery to the jobsite to be turned over to the CM.
5. The vendor is to include any storage required prior to the delivery date.
6. The vendor shall include the standard one year warranty. The warranty shall not start on the date of delivery – the warranty shall start on the date of Substantial Completion as defined by the Project Schedule included in the RFP Documents.
7. Provide a factory-authorized representative to perform the following startup services:

    a. Perform the following field tests and inspections and prepare test reports:

        i. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
        ii. Test and adjust controls and safeties.
        iii. Test each system for compliance with sequence of operation.

Equipment Package 2 – Medium Voltage Switchgear:

1. Provide Medium Voltage Switchgear as defined by Spec Section 261300
2. Coordinate with all mechanical, plumbing and electrical design documents to create a fully coordinated submittal for each component.
3. Provide delivery to the jobsite to be turned over to the CM.
4. The vendor is to include any storage required prior to the delivery date.
5. The vendor shall include the standard one year warranty. The warranty shall not start on the date of delivery – the warranty shall start on the date of Substantial Completion as defined by the Project Schedule included in the RFP Documents.
6. Provide a factory-authorized representative to perform the following startup services:

    a. Perform the following field tests and inspections and prepare test reports:

        i. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
        ii. Test and adjust controls and safeties.
        iii. Test each system for compliance with sequence of operation.

Equipment Package 3 – Generator ATS:

1. Provide emergency generator systems as defined by Spec Section 263213.13
2. Provide Automatic Transfer Switches as defined by Spec Section 263600
3. Generators and ATS defined by Drawings E310B and E500.
4. Coordinate with all mechanical, plumbing and electrical design documents to create a fully coordinated submittal for each component.
5. Provide delivery to the jobsite to be turned over to the CM.
6. The vendor is to include any storage required prior to the delivery date.
7. The vendor shall include the standard one year warranty. The warranty shall not start on the date of delivery – the warranty shall start on the date of Substantial Completion as defined by the Project Schedule included in the RFP Documents.
8. Provide a factory-authorized representative to perform the following startup services:

    a. Perform the following field tests and inspections and prepare test reports:

        i. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
        ii. Test and adjust controls and safeties.
        iii. Test the Generator and Transfer Switches in accordance with specifications and the Manufacturers requirements.
        iv. Test each system for compliance with sequence of operation.

Equipment Package 4 - AHU:

1. Provide custom air-handling systems as defined by Spec Section 237323
2. Provide Hydronic Air Coils as defined by Spec Section 238216.11
3. Provide Steam Air Coils as defined by Spec Section 238216.12
4. Coordinate with all mechanical, plumbing and electrical design documents to create a fully coordinated submittal for each component.
5. Provide delivery to the jobsite to be turned over to the CM.
6. The vendor is to include any storage required prior to the delivery date.
7. The vendor shall include standard the warranty. The warranty shall not start on the date of delivery – the warranty shall start on the date of Substantial Completion as defined by the Project Schedule included in the RFP Documents.
8. Furnish extra materials described below that match products installed. These extra materials are to be packaged with protective covering for storage, and are identified with labels describing contents.
    a. Filters: Furnish 1 set for each pre-filter bank of the custom air-handling unit.
    b. Trolley: One Coffing Trolley or equal capable of supporting twice the expected load.
9. Walls of the air handling unit shall be wipe down construction.

Equipment Package 5 – Variable Frequency Drives:

1. Provide Variable Frequency Drives as defined by Spec Section 230950.
2. Drawing reference – H500
3. Provide variable frequency drives for the supply and return fans in air handlers AHU-1, 2, 3, & 4 and pumps CWP-1, HWP-1 & HWP-2.
4. Coordinate with all mechanical, plumbing and electrical design documents to create a fully coordinated submittal for each component.
5. Provide delivery to the jobsite to be turned over to the CM.
6. The vendor is to include any storage required prior to the delivery date.
7. The vendor shall include the standard one year warranty. The warranty shall not start on the date of delivery – the warranty shall start on the date of Substantial Completion as defined by the Project Schedule included in the RFP Documents.
8. Provide a factory-authorized representative to perform the following startup services:

    a. Perform the following field tests and inspections and prepare test reports:

        i. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
        ii. Test and adjust controls and safeties.
        iii. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
        iv. Test each system for compliance with sequence of operation.
        v. Test software and hardware interlocks.

8.0 FINANCIAL OFFER SUMMARY

Please complete and submit “Attachment A – Financial Offer for UK-2321-23”.

Financial Offer for UK-2321-23

Base Bid for Equipment Package: **Number/Name**: _____

The Bidder agrees to furnish all materials, supplies and services required to complete the Work, for the above referenced Project, for the Capital Construction Procurement Section, University of Kentucky, as described in the RFP including Attachments and as modified by the Addenda listed above.

FOR THE LUMP SUM OF_____
(USE WORDS)
_____DOLLARS AND_____CENTS.
(USE WORDS) (USE WORDS)

($_____)
(USE FIGURES)

8.2 Optional and Unit Pricing:

Please provide Optional Pricing for items identified in Section 4.6, question 8 – Services Defined

Prices shall include the furnishing of all labor, materials, supplies and services and shall include all items of cost, overhead and profit for the Contractor and any subcontractor involved.

Also, provide **Unit Pricing** that may apply for this project. Unit Pricing shall be used uniformly without modifications for either additions or deductions. The Unit Prices as established shall be used to determine the equitable adjustment of the Contract Price in connection with changes, deletions or extra work performed under the Contract and the "Rules of Measurement" set forth in the General Conditions shall govern.

All Offerors will be required to complete and submit the following information. The information requested in this submittal is required to assist the University in determining contractor responsibility to complete the project being bid.

8.3 Equipment Delivery

Freight included in Price YES_____ NO_____

Freight estimate $_____

Method of Shipment _____

Transportation will take approximately _____ Days

Shipment date after receipt of order _____

Shipment date after receipt of approval drawings _____

8.4 Drawings/Manuals

Approval Drawings to be submitted _____# of weeks after order.

"AS Built" Drawings to be submitted _____ # of weeks after construction completion.

8.5 Help wth Assembly

Provide contactor help with assemble? YES_____ NO_____

8.6 Start-up, Training, Spare Parts & Additional Services

No. of Start-up days included _____

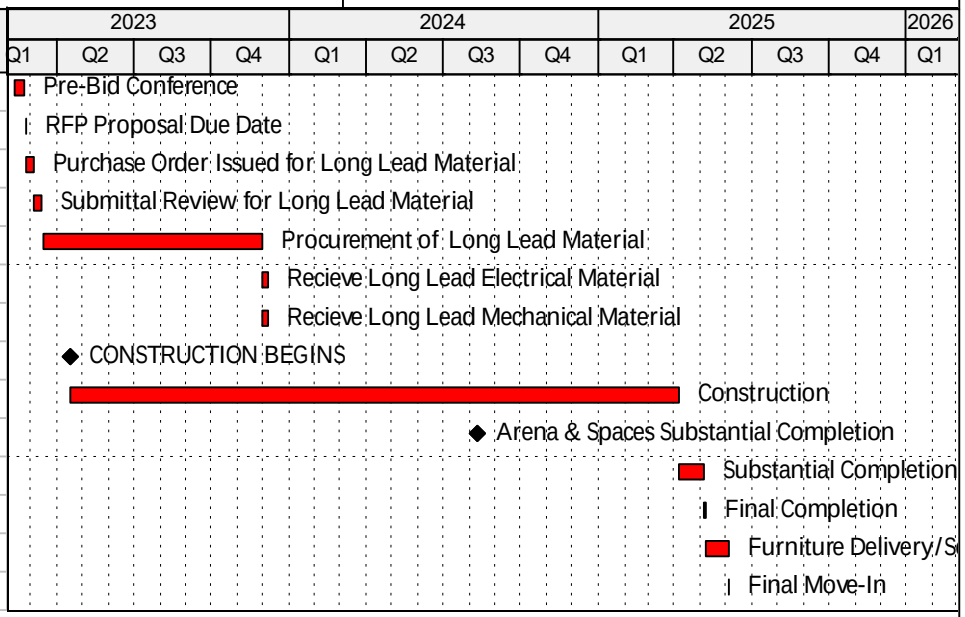
No. of Training days included _____

Long Lead MEP - RFP

University of Kentucky
Memorial Coliseum Renovation

CONGLETON - HACKER CO.
Construction Managers / General Contractors

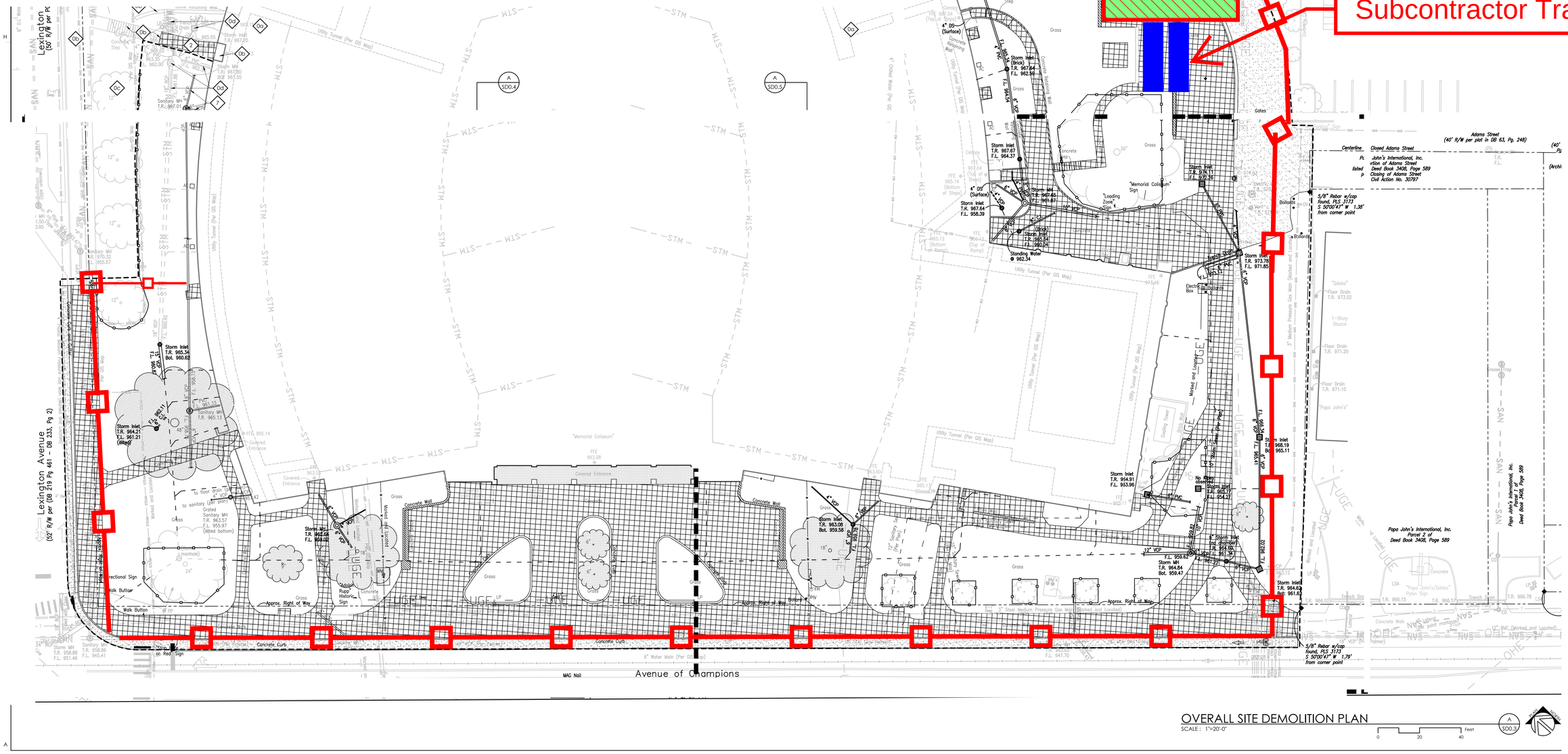
Activity Name	Original Duration	Start	Finish
Pre-Bid Conference	14	09-Feb-23*	22-Feb-23
RFP Proposal Due Date	1	23-Feb-23*	23-Feb-23
Purchase Order Issued for Long Lead Materi	10	23-Feb-23*	04-Mar-23
Submittal Review for Long Lead Material	10	05-Mar-23*	14-Mar-23
Procurement of Long Lead Material	260	15-Mar-23*	29-Nov-23
Recieve Long Lead Electrical Material	5	29-Nov-23	06-Dec-23
Recieve Long Lead Mechanical Material	5	29-Nov-23	06-Dec-23
CONSTRUCTION BEGINS	0	17-Apr-23*	
Construction	721	17-Apr-23*	06-Apr-25
Arena & Spaces Substantial Completion	0	10-Aug-24*	
Substantial Completion of Total Project	30	07-Apr-25*	06-May-25
Final Completion	1	07-May-25*	07-May-25
Furniture Delivery/Setup	28	08-May-25	04-Jun-25
Final Move-In	1	05-Jun-25*	05-Jun-25



Actual Work
Critical Remaining Work
Remaining Work
Milestone

UK Memorial Coliseum

Site Logistics Plan



UNIVERSITY OF KENTUCKY
GENERAL TERMS AND CONDITIONS

1. Definitions:

Contract – The entire written agreement between the parties including, but not limited to, the Invitation for Bid or Request for Proposal and its specifications, terms, and conditions, solicitation instructions, solicitation addenda, contractor's offer, the contract document, and contract amendments if any, including, without limitations, these General Terms and Conditions and the purchase order or price agreement document excluding correspondence of any type unless specifically accepted by both parties in writing.

Contractor – A person, company, corporation, organization, or other legal entity with whom the University has executed a Contract.

University – The University of Kentucky, an agency and instrumentality of the Commonwealth of Kentucky.

"Authorized Employees" means Contractor's employees or work force members (as defined by 45 C.F.R. 160.103) who have a need to know or otherwise access University Data to enable Contractor to perform its obligations under this Agreement.

"Authorized Persons" means (i) Authorized Employees; and (ii) Contractor's contractors, agents, outsourcers, and auditors who have a need to know or otherwise access University Data to enable Contractor to perform its obligations under this Agreement, and who are bound in writing by confidentiality and data protection obligations, including, without limitation, those set forth in a business associate agreement, sufficient to protect University Data in accordance with the terms and conditions of this Agreement.

"University Data" means any information, in an electronic, written, or oral form, that is made available to the Contractor by the University. University Data includes, but is not limited to, PII, trade secrets, sales and marketing plans, financial data, supplier information, and intellectual property.

"Personally Identifiable Information (PII)" means any information about an individual, including (1) any information that can be used to distinguish or trace an individual's identity, such as name, social security number, date and place of birth, mother's maiden name, or biometric records; and (2) any other information that is linked or linkable to an individual, such as medical, educational, financial, and employment information. PII, includes, but is not limited to, Personal Information as defined by KRS 61.931(6) and Protected Health Information (PHI) as defined by 45 CFR 160.103.

2. Applicability of General Terms and Conditions:

These terms are in addition to the terms and conditions set forth in any solicitation document and/or purchase agreement and should be read in conjunction with the same unless the document indicates otherwise. To the extent that Contractor terms and conditions conflict with these University of Kentucky General Terms and Conditions, the latter shall control. Either party's failure to insist upon the performance of any provision of these General Terms and Conditions shall not be construed as a waiver of that party's present or future right to such performance and each party's obligation in respect thereto shall continue in full force and effect.

3. Contract Provisions by Reference:

It is mutually agreed by and between the University and the Contractor that the University's acceptance of the Contractor's offer by the issuance of a Purchase Order or Contract shall create an agreement between the parties thereto containing the following:

- All specifications, terms and conditions in the solicitation document except as amended in the contract.

- The provision of the awarded contract to include all terms, special conditions, specifications, and the Contractor's offer.

- The University of Kentucky General Terms and Conditions.

Unless otherwise specified, in the event of any conflicts, the documents shall control in the following order:

1) the written contract or purchase order (if any);
2) contractor's exceptions, if expressly accepted by University;
3) the RFP, bid or other solicitation document;
4) University of Kentucky General Terms and Conditions; and
5) Contractor's offer.

4. Governing Law:

The contractor shall conform to and observe all laws, ordinances, rules and regulations of the United States of America, Commonwealth of Kentucky and all other local governments, public authorities, boards or offices relating to the property or the improvements upon same (or the use thereof) and will not permit the same to be used for any illegal or immoral purposes, business or occupation. The resulting contract shall be governed by Kentucky law and any claim relating to this contract shall only be brought in the Franklin Circuit Court in accordance with KRS 45A.245.

5. Indemnification:

The Contractor shall indemnify, hold and save harmless the University, its affiliates and subsidiaries and their officers, agents, and employees from losses, claims, suits, actions, expenses, damages, costs (including attorney fees of attorneys of the University's choice and court costs) expenses, all liability of any nature or kind arising out of or relating to the Contractor's performance hereunder. This clause shall survive the termination of any contract for as long as necessary to protect the University.

6. Insurance:

The successful Contractor shall procure and maintain, at its expense, the following minimum insurance coverages insuring all services, work activities and contractual obligations undertaken in this contract. These insurance policies must be with insurers acceptable to the University. Insurance requirements may be modified in the Special Conditions of any solicitation document. In such cases, the insurance requirements of the Special Conditions shall prevail.

COVERAGES	***LIMITS***
Workers' Compensation	**Statutory Requirements (Kentucky)**
Employer's Liability	**$500,000/$500,000/$500,000**
Commercial General Liability, including operations/ completed operations, products, and contractual liability (including defense and investigation costs) including this contract.	**$1,000,000 each occurrence (BI & PD combined) $2,000,000 Products and Completed Operations Aggregate**
Business Automobile Liability, covering owned, leased, or non-owned autos	**$1,000,000 each occurrence (BI & PD combined)**

The successful Contractor agrees to furnish Certificates of Insurance for the above described coverages and limits to the University of Kentucky Division of Purchasing. The University, its trustees and employees must be added as Additional Insured on the Commercial General

Liability policy with regards to the scope of this RFP/contract. Any deductibles or self-insured retention in the above-described policies must be paid and are the sole responsibility of the Contractor. Coverage is to be primary and non-contributory with other coverage, if any, purchased by the University. All of these required policies must include a Waiver of Subrogation, except Workers' Compensation, in favor of the University, its trustees and employees.

7. Termination for Convenience:

The University of Kentucky, Purchasing Division, reserves the right to terminate the resulting contract without cause with a thirty (30) day written notice. Upon receipt by the contractor of a "notice of termination," the contractor shall discontinue all services with respect to the applicable contract. The cost of any agreed upon services provided by the contractor will be calculated at the agreed upon rate prior to a "notice of termination" and a fixed fee contract will be pro-rated (as appropriate).

8. Termination for Non-performance:

Default

The University may terminate the resulting contract for non-performance, as determined by the University, for such causes as:

- Failing to provide satisfactory quality of service, including, failure to maintain adequate personnel, whether arising from labor disputes, or otherwise any substantial change in ownership or proprietorship of the Contractor, which in the opinion of the University is not in its best interest, or failure to comply with the terms of this contract;

- Failing to keep or perform, within the time period set forth herein, or violation of, any of the covenants, conditions, provisions, or agreements herein contained.

- Adjudicating as a voluntarily bankrupt, making a transfer in fraud of its creditors, filing a petition under any section from time to time, or under any similar law or statute of the United States or any state thereof, or if an order for relief shall be entered against the Contractor in any proceeding filed by or against contractor thereunder. In the event of any such involuntary bankruptcy proceeding being instituted against the Contractor, the fact of such an involuntary petition being filed shall not be considered an event of default until sixty (60) days after filing of said petition in order that Contractor might during that sixty (60) day period have the opportunity to seek dismissal of the involuntary petition or otherwise cure said potential default; or

- Making a general assignment for the benefit of its creditors, or taking the benefit of any insolvency act, or if a permanent receiver or trustee in bankruptcy shall be appointed for the Contractor.

Demand for Assurances

In the event the University has reason to believe Contractor will be unable to perform under the Contract, it may make a demand for reasonable assurances that Contractor will be able to timely perform all obligations under the Contract. If Contractor is unable to provide such adequate assurances, then such failure shall be an event of default and grounds for termination of the Contract.

Notification

The University will provide ten (10) calendar days written notice of default. Unless arrangements are made to correct the non-performance issues to the University's satisfaction within ten (10) calendar days, the University may terminate the contract by giving forty-five (45) days notice, by registered or certified mail, of its intent to cancel this contract.

9. Attorney's Fees:

In the event that either party deems it necessary to take legal action to enforce any provision of the contract, and in the event the University prevails, the Contractor agrees to pay all expenses of such action, including attorney's fees and costs at all stages of litigation.

10. Breach of University Data:

Contractor acknowledges and agrees that, in the course of its engagement by University, Contractor may receive or have access to University Data. Contractor shall comply with the terms and conditions set forth in this Agreement and the Business Associate Agreement between University and Contractor in its collection, receipt, transmission, access, storage, disposal, use and disclosure of such University Data and be responsible for the unauthorized collection, receipt, transmission, access, storage, disposal, use and disclosure of University Data under its control or in its possession by all Authorized Persons. Contractor shall be responsible for, and remain liable to, University for the actions and omissions of all Authorized Persons that are not Authorized Employees concerning the treatment of University Data as if they were Contractor's own actions and omissions.

In recognition of the foregoing, Contractor agrees and covenants that it shall:

- keep and maintain all University Data in strict confidence, using such degree of care as is appropriate to avoid unauthorized acquisition, access, use or disclosure;

- use and disclose University Data solely and exclusively for the purposes for which the University Data, or access to it, is provided pursuant to the terms and conditions of this Agreement, and not use, sell, rent, transfer, distribute, or otherwise disclose or make available University Data for Contractor's own purposes or for the benefit of anyone other than University, in each case, without University's prior written consent;

- not, directly or indirectly, disclose University Data to any person other than its Authorized Employees, including any, subcontractors, agents, outsourcers or auditors (an "Unauthorized Third Party"), without express written consent from University unless and to the extent required by applicable law, in which case, Contractor shall (i) notify University before such disclosure or as soon thereafter as reasonably possible; (ii) be responsible for and remain liable to University for the actions and omissions of such Unauthorized Third Party concerning the treatment of such University Data as if they were Contractor's own actions and omissions; and (iii) require the Unauthorized Third Party that has access to University Data to execute a written agreement agreeing to comply with the terms and conditions of the Contract, including, without limitation, executing a business associate agreement where applicable;

- abide by all applicable federal and state laws, rules, and regulations regarding privacy and confidentiality, including PII and otherwise; and

- limit the acquisition, access, use and disclosure of University Data to Authorized Persons only in the amount minimally necessary for Contractor to perform its obligations under this Agreement.

11. Regulatory Requirements and General IT Controls:

Contractor shall implement administrative, physical and technical safeguards to protect data that are no less rigorous than accepted industry practices including the International Organization for Standardization's standards: ISO/IEC 27001:2013 (Information Security Management Systems – Requirements) and ISO-IEC 27002:2013 (Code of Practice for International Security Management) and shall ensure that all such safeguards, including the manner in which data is created, received, maintained, transmitted, collected, accessed, used, stored, processed, disposed of and disclosed, comply with applicable data protection and privacy laws, as well as the terms and conditions of this Agreement.

12. Auditing of University Data:

Contractor represents and warrants that it maintains adequate internal audit functions to annually assess internal controls in its environment, and to protect the security and confidentiality of any of University's data. Contractor agrees to provide documentation regarding its internal controls to University upon request. Contractor will provide to University all internal or external audit reports, certifications, information, documentation, electronic records and data regarding Contractor's internal controls, and if requested by University, Contractor will grant University and its University agents or subcontractors, the right to audit Contractor's operations, systems and software to confirm internal controls are present and operating.

If the information presented to University regarding Contractor's internal controls is not acceptable to University in its reasonable discretion, Contractor agrees that it will undertake, at its sole cost and expense, an independent SSAE 16 Type II audit or comparable independent attestation to confirm Contractor's controls over its processes. Contractor shall present an action plan acceptable to University, to correct any and all portions of the systems, software, products, documentation, or internal

controls. Contractor shall undertake all activities relating to its preparation of the action plan, and to its correction of any inadequate controls or mitigation of risks revealed by deficiencies in its internal controls at Contractor's sole cost and expense and within a reasonable time period as agreed upon by University. Should Contractor fail to provide adequate internal controls as described in the Contract, or to present an action plan acceptable to University within the mutually agreed upon time frame, University shall be entitled, in its sole discretion, to terminate the Contract with no liability whatsoever to Contractor upon written notice to the Contractor.

13. Contractor Personnel:

Upon University request, Contractor shall be responsible, at its sole cost and expense, for conducting full background checks on any and all employees, consultants, independent contractor, or work force members (as defined by 45 C.F.R. 160.103) that Contractor intends to utilize in providing services to University. Such background checks shall cover a period of not less than five years prior to the date the background check is initiated and shall include but is not limited to the following: comprehensive review of criminal history, drug test and screen, credit review, and a confidentiality agreement regarding access to University information signed by the individual. At the University's sole and absolute discretion, the results of the background check or drug screening are unsatisfactory to University, University can refuse to accept any such proposed Consultant or personnel, and Contractor shall provide University with another Consultant, or personnel that passes the background screening and drug testing procedures to University's satisfaction at no additional cost to University.

14. Compensable Damages for Breach:

The Contractor agrees that the following items shall be included as compensable damages for any breach of a contract with the University.

- Replacement costs.
- Cost of repeating the competitive bidding procedure expenses.
- Expenses incurred as the result of delay in obtaining replacements.

The enumeration of compensable damage contained in this section is not intended to be exclusive and will not operate to bar recovery by the University for any other damages occasioned by the Contractor's breach of a contract. However, in cases where contract provides for liquidated damages, said liquidated damages shall be in lieu of all other damages, including those enumerated

15. Assignment and Subcontracting:

The Contractor(s) may not assign or delegate its rights and obligations under any contract in whole or in part without the prior written consent of the University. Any attempted assignment or subcontracting shall be void.

16. Contractor's Responsibility in Performing Work:

The Contractor is solely responsible for the fulfillment of the contract with the University.

Contractor and its agents, subcontractors, and representatives shall be independent contractors and not act as agents of the University. All persons furnished or retained by Contractor in connection with any contract shall be considered employees or agents of the Contractor.

Contractor shall control all employee misconduct while on the University's premises. Any employee under the influence of alcohol or controlled substances, other than prescription medications, shall not be allowed on the premises of the University and shall be permanently dismissed if found to be so. Further, offensive language, sexual or other types of harassment of students, employees or visitors to the University campus could result in immediate and permanent dismissal of the offending person(s) from the University site.

Contractor shall comply with the University's tobacco-free policy. This policy prohibits the use of tobacco in or around its facilities including UK HealthCare. Additional information on this policy is available at: http://www.uky.edu/TobaccoFree/.

Contractor shall ensure that employees abide by any applicable University policies and regulations concerning behavior/conduct.

17. Contractor Cooperation in Related Efforts:

The University reserves the right to undertake or award other contracts for additional or related work to other entities. The contractor shall fully cooperate with such other contractors and University employees and carefully fit its work to such additional work. The contractor shall not commit or permit any act which will interfere with the performance of work by any other contractor or by University employees. This clause shall be included in the contracts of all contractors with whom this contractor will be required to cooperate. The University shall equitably enforce this clause to all contractors to prevent the imposition of unreasonable burdens on any contractor.

18. Additions, Deletions or Contract Changes:

The University reserves the right to add, delete, or change related items or services to any contract. No modification or change of any contract provision shall be made unless such modification is mutually agreed to in writing by the Contractor and the University and incorporated as a written modification to the contract. Memoranda of understanding and correspondence shall not be interpreted as a modification to or part of the contract, unless specifically agreed to by both parties.

19. Permits, Licenses and Taxes:

The contractor shall procure all necessary permits and licenses and abide by all applicable laws, regulations, and ordinances of all federal, state, and local governments in which work under this contract is performed.

The contractor must furnish certification of authority to conduct business in the Commonwealth of Kentucky as a condition of contract award. Such registration is obtained from the Secretary of State, who will also provide the certification thereof. However, the contractor need not be registered as a prerequisite for responding to the RFP.

The contractor shall pay any sales, use, personal property and other tax arising out of this contract and the transaction contemplated hereby. Any other taxes levied upon this contract, the transaction or the equipment or services delivered pursuant hereto shall be the responsibility of the contractor.

The contractor will be required to accept liability for payment of all payroll taxes or deductions required by local and federal law including (but not limited to) old age pension, social security, or annuities.

20. University Brand Standards

The contractor must adhere to all University of Kentucky Brand Standards. University Brand Standards are maintained by the University Public Relations Office (UKPR) and can be viewed at http://www.uky.edu/pmarketing/brand-standards. Non-adherence to the standards can have a penalty up to and including contract cancellation. Only the UKPR Director or designee can approve exceptions to the University standards.

Graphics standards for the UK HealthCare areas are governed by UK HealthCare Clinical Enterprise Graphic Standards, found at: https://ourbrand.ukhealthcare.org.

Contractor warrants that its products or services provided hereunder will be in compliance with all applicable Federal disabilities laws and regulations, including without limitation the accessibility requirements of Section 255 of the Federal Telecommunications Act of 1996 (47 U.S.C. § 255) and Section 508 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794d), and its implementing regulations set forth at Title 36, Code of Federal Regulations, Part 1194. For purposes of clarity, updated regulations under Section 508 standards now incorporate WCAG 2.0, and for purposes of this agreement WCAG 2.0 Level AA compliance is expressly included. Contractor agrees to promptly respond to, resolve and remediate any complaint regarding accessibility of products or services in a timely manner and provide an updated version to University at no cost. If deficiencies are identified, University reserves the right to request from Contractor, a timeline by which accessibility standards will be incorporated into the products or services provided by Contractor and shall provide such a timeline within a commercially reasonable duration of time. Failure to comply with these requirements shall constitute a material breach of this Agreement and shall be grounds for termination of this Agreement.

Where any customized web services are provided, Contractor represents that it has reviewed the University's Web Policy and all products or services will comply with its published standards.

Contractor will provide University with a current Voluntary Product Accessibility Template (VPAT) for any deliverable(s). If none is available, Vendor will provide sufficient information to reasonably assure the University that the products or services are fully compliant with current requirements.

21. Royalties, Patents, Copyrights and Trademarks:

The Contractor shall pay all applicable royalties and license fees. If a particular process, products or device is specified in the contract documents and it is known to be subject to patent rights or copyrights, the existence of such rights shall be disclosed in the contract documents and the Contractor is responsible for payment of all associated royalties. To the fullest extent permitted by law the Contractor shall indemnify, hold the University harmless, and defend all suits, claims, losses, damages or liability resulting from any infringement of patent, copyright, and trademark rights resulting from the incorporation in the Work or device specified in the Contract Documents.

Unless provided otherwise in the contract, the Contractor shall not use the University's name nor any of its trademarks or copyrights, although it may state that it has a Contract with the University.

22. Copyright Ownership and Title to Designs and Copy:

Contractor and University both consider the products and results of the services to be rendered by Contractor to be a work made for hire. Contractor acknowledges and agrees that the work and all rights therein, including, without limitation, copyright, belongs to and shall be the sole and exclusive property of the University. For any work that is not considered a work made for hire under applicable law, title and copyright ownership shall be assigned to the University.

Title to all dies, type, cuts, artwork, negatives, positives, color separations, progressive proofs, plates, copy, and any other requirement not stated herein required for completion of the finished product for use in connection with any University job shall be the property of and owned by the University. Such items shall be returned to the appropriate department upon completion and/or delivery of work unless otherwise authorized by the University. In the event that time of return is not specified, Contractor shall return all such items to the appropriate University department within one week of delivery.

23. Proprietary Information, Data Duplication, and Disclosure:

Contractor agrees that any information disclosed from the University to the Contractor for the purpose of any contract shall be used only in the performance of the contract. Contractor will keep information confidential, will not disclose it to any third party except as authorized by the Owner, and will only disclose it to those within its organization who need to use it in performance of the Contract. Upon completion or termination of this contract, Contractor shall return all such information to the University or make such other disposition thereof as may be directed or approved by the University.

No item furnished under this contract, or tools, plans, designs, or specifications for producing the same which have been specifically designed for or by the University shall be duplicated or used by Contractor. Upon completion or termination of this contract, Contractor shall return all items, tools, plans, designs, or specifications to the University or make such other disposition thereof as may be directed by or approved by the University.

Contractor agrees that it will not, without prior written approval of the University, publicize this contract or disclose, confirm or deny any details thereof to third parties, or use the University's name in connection with Contractor's sales promotion or publicity without prior written approval of the University.

Nothing in this provision shall restrict Contractor's right to use or disclose any information which is or becomes generally known to the public without breach of this provision by Contractor or is rightfully obtained without restriction from other sources.

24. Contractor's Responsibility for Records, Audits and Reports:

Contractor shall retain all records and documents and shall provide unlimited access, at all reasonable times and upon reasonable notice, to all accounting records and supporting documentation relating to the goods and services furnished during any contract and for a period of five (5) years thereafter, unless required to be retained for a longer period by state or federal statute. Should such audit disclose incorrect billings or improprieties, the University reserves the right to charge the Contractor for the cost of the audit and pursue appropriate reimbursement.

Contractor will be responsible for providing line item usage reports to the UK Purchasing Division on a quarterly basis. The Purchasing Division reserves the right to request other pertinent reports.

25. Non-discrimination and Equal Opportunity:

Contractor shall comply with the University's nondiscrimination policy and shall not in its operations or employment practices discriminate on the basis of race, color, national origin, ethnic origin, religion, creed, age, physical or mental disability, veteran status, uniformed service, political belief, sex, sexual orientation, gender identity, gender expression, pregnancy, marital status, genetic information, social or economic status, or smoker or nonsmoker status, as long as the person complies with the University's policy concerning smoking.

Contractor is subject to and shall comply with all applicable Federal, state, and local laws and regulations governing equal employment opportunity and affirmative action including, but not limited to, the Kentucky Equal Employment Act of 1978 (KRS 45.550 et. seq. of the Kentucky Revised Statutes) and the Federal requirements set forth in Titles VI and VII of Civil Rights Act of 1964, as amended; Sections 503 and 504 of the Rehabilitation Act of 1973, as amended; the Americans with Disabilities Act of 1990, as amended; Executive Order 11246 as amended; The Age Discrimination in Employment Act of 1967, as amended; the Age Discrimination Act of 1975, as amended; The Vietnam Era Veterans' Readjustment Assistance Act of 1974, as amended; Title II of the Genetic Information Nondiscrimination Act of 2008, as amended; and all regulations and administrative rules established pursuant to the foregoing laws.

26. Contractor and Subcontractor Responsibility with Federally Funded Contracts:

Contractor shall comply with "Contract Provisions for Non-Federal Entity Contracts Under Federal Awards". The provisions may be viewed at this link.

Contractors and subcontractors, receiving payments from the University via federally awarded contracts, shall comply with all applicable laws and regulations related to equal opportunity and non-discrimination.

Contractor shall abide by the requirements of 41 CFR §§ 60-1.4(a). Among other things, this regulation prohibits discrimination against qualified individuals because of race, color, religion, sex, sexual orientation, gender identity or national origin (see specifics below).

Contractor and subcontractor shall abide by the requirements of 41 CFR 60-741.5(a). This regulation prohibits discrimination against qualified individuals based on the basis of disability and requires affirmative action by covered prime contractors and subcontractors to employ and advance in employment qualified individuals with disabilities.

Contractor and subcontractor shall abide by the requirements of 41 CFR 60-300.5(a). This regulation prohibits discrimination against qualified protected veterans and requires affirmative action by covered prime contractors and subcontractors to employ and advance in employment qualified protected veterans.

During the performance of this Contract, Contractor agrees as follows:

(a) Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity or national origin. Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during

employment, without regard to their race, color, religion, sex, sexual orientation, gender identity or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.

(b) Contractor will, in all solicitation or advertisements for employees placed by or on behalf of Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity or national origin.

(c) Contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with Contractor's legal duty to furnish information.

(d) Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other Contract or understanding, a notice advising the said labor union or workers' representative of Contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, as amended, and shall post copies of the notice in conspicuous places available to employees and applicants for employment. Contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance.

(e) Contractor will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(f) Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, as amended, and by the rules, regulations and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations and orders.

(g) In the event of Contractor's noncompliance with the nondiscrimination clauses of this Agreement or with any of the said rules, regulations or orders, this Agreement may be cancelled, terminated, or suspended in whole or in part and Contractor may be declared ineligible for further Government Contracts or Federally-assisted construction Contracts in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, as amended, and such other sanctions may be imposed and remedies invoked as provided in said Executive Order or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(h) Contractor will include the provisions of paragraphs (1) through (8) of Section 202 of Executive Order 11246 in every subcontract or purchase order unless exempted by rules, regulations or orders of the Secretary of Labor, issued pursuant to Section 204 of Executive Order 11246 of September 24, 1965, as amended, so that such provisions will be binding upon each subcontractor or vendor.

Contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions including sanctions for noncompliance; provided, however, that in the event Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction, Contractor may request the United States to enter into such litigation to protect the interests of the United States.

27. Open Records:

Any contract with the University, and all related information and documentation may be subject to public disclosure under the Kentucky Revised Statutes 61.870 et. seq. Contractor is hereby notified that the University strictly adheres to this statute and the interpretations thereof rendered by the courts and the Kentucky Attorney General. Contractor shall be deemed to have knowledge of this law and the means of protecting Contractor's legitimate interests.

28. Debarred, Suspended and Ineligible Status:

Contractor certifies that is has not been debarred, suspended, or declared ineligible as defined in the Federal Acquisition Regulation (FAR 48 C.F.R Ch. 1 Subpart 9.4). Contractor will immediately notify the University if the Contractor is placed on the Consolidated List of Debarred, Suspended, and Ineligible Contractors.

29. Conflicts of Interest:

Contractor affirms that, to the best of Contractor's knowledge, there exist no conflicts of interest between the Contractor of the University or its employees as defined by all applicable Kentucky Revised Statutes and University of Kentucky ethics and compliance policies and procedures.

In the event of change in Contractor's interests, Contractor shall inform the University regarding any conflicts of interest that are likely to arise as a result of such change. Contractor hereby represents that it has not participated in any illegal or unethical conduct in connection with the contract. If, at any time, the University determines the Contractor is in violation of the forgoing representation, the University may cancel the contract upon written notice to the Contractor and the University shall have no further obligation to the Contractor.

30. General Warranties:

Contractor warrants that all goods shall conform to the specifications of the contract and shall be merchantable, free from defects (including defects in design and fit) and suitable for the intended purposes. Contractor further warrants that all services shall conform to the specifications of the contract and shall be performed in a professional and workmanlike manner. These warrantees shall remain in effect for at least one year following University's acceptance of the goods or services or for the duration of Contractor's standard warranty period if such period exceeds one year. The foregoing warranties are in addition to, and shall not limit, any other warranties or buyer protections that exist by operation of law.

31. Price Warranty:

Contractor warrants that the price(s) for the articles or services sold to the University hereunder are not less favorable than those extended to any other customer (whether government or commercial) for the same or similar articles or services in similar quantities. In the event Contractor reduces its price(s) for such articles or services during the term of this contract, Contractor agrees to reduce the

prices hereof accordingly. Contractor warrants that prices shown on this contract shall be complete, and no additional charges of any type shall be added without the University's express written consent. Such additional charges include, but are not limited to, shipping, packaging, labeling, customs, duties, taxes, storage, insurance, boxing, and crating.

32. Final Inspection and Acceptance:

The University reserves the right to perform inspection and/or expediting of the materials and fabrication thereof at the facility of the Contractor or its suppliers at any reasonable times. All materials and services are subject to final inspection and acceptance by the University at destination, notwithstanding any prior payments or inspection at the source. Such final inspection shall take place within thirty (30) days from the date of delivery or installation or completion of services whichever is latest.

In addition to other remedies which may be available under law or in equity, when services are not delivered on the date agreed on by the contractor and the University, or if inferior or incomplete work is found, the Purchasing Division (in concurrence with the department) reserves the right to reject such materials and request replacement as stated above or authorize the contractor to issue a credit based on the University's cost for all material found unacceptable the University, at its option may return to the Contractor any nonconforming or defective item(s), at no cost to the University, and require correction or replacement of the item(s). If the University does not require correction or replacement of nonconforming or defective item(s), Contractor shall repay such portion of the contract price or such additional amount as is equitable under the circumstances. The rights of the University are in addition to and shall not be limited by Contractor's standard warranties.

33. Delivery, Transportation and Packaging:

The Contractor covenants that, if awarded a contract, the Contractor shall:

Adequately pack all commodities and equipment according to accepted commercial practice and according to the packing and marking instructions stated in the contract documents or purchase order.

Make deliveries as stated in the contract; it is understood by the Contractor that all deliveries shall be made by the end of the University's fiscal year in which the contract is awarded unless otherwise specified in a specific contract.

Make deliveries during normal working day hours to the point or points specified in the contract documents or purchase order unless otherwise noted.

34. Price Redetermination:

Prices quoted shall be firm and fixed unless otherwise stipulated in the Special Conditions of the Invitation For Bid. For multiple year contracts, prices shall remain firm and fixed during the initial term of the contract. At the end of the initial contract term, and at the end of each contract term thereafter, the Contractor may request a price adjustment. Such requests must be submitted in writing at least 60 calendar days prior to the end of the contract term and shall include the cause for the adjustment, the amount of change requested, and documentation to support the requested adjustment.

Only pass through price adjustments will be considered and any proposed price increase must be proven to be general throughout the industry. Requests for price increases must be accompanied by sufficient documentation to justify the request including, for example, certified letters from a manufacturer or published price indices such as the Producer Price Index that substantiate a price increase.

The University Contracting Officer must agree to and approve any proposed price adjustment before its effective date. The adjusted price(s) become effective starting with the term beginning after the approval and shall be firm and fixed for the next contract term.

35. Procurement Card:

The University utilizes a procurement card program as a method of payment. The University assumes that all successful bidders will accept the University's procurement card as a method of payment unless a specific exception is stated in the bidder's response to the Invitation For Bid. No additional charges may be added for acceptance of the procurement card.

36. Freight:

The University's freight terms are F.O.B. destination, freight prepaid and allowed. If shipment is indicated on the purchase order as freight prepaid and added, the Contractor will prepay the freight charges and, if mutually agreed to, add them to the invoice. Separate freight invoices will not be accepted. Collect shipments will be returned at Contractor's expense unless otherwise instructed by the University.

37. Damaged or Inferior Material:

All damaged shipments or inferior material will be rejected by the University and immediate notification will be given to the contractor. Any rejection of delivery for damaged or inferior materials by the University must be replaced by the contractor within ten (10) working days.

When services are not delivered on the date agreed on by the contractor and the University, or if inferior or incomplete work is found, the Purchasing Division (in concurrence with the department) reserves the right to reject such materials and request replacement as stated above or authorize the contractor to issue a credit based on the University's cost for all material found unacceptable.

38. University of Kentucky HealthCare Enterprise:

The University of Kentucky includes a clinical enterprise, UK HealthCare, which consists of the Colleges of Medicine, Dentistry, Pharmacy, Nursing, Health Sciences and Public Health, the University Hospital Ambulatory Surgery Center, a multi-site physician group practice known as the Kentucky Clinic, and such other facilities as may be added from time to time which provide education, research, and an array of clinical programs. When providing goods or services to the UK HealthCare enterprise, the Contractor understands and agrees to abide by any and all regulatory requirements unique to a clinical enterprise including, but not limited to, the following:

The Contractor represents and warrants that UK HealthCare operates in accordance with a corporate compliance program and the Contractor agrees to adhere to the UK HealthCare compliance standards. The Contractor is informed that a copy of the compliance plan is available from the UK HealthCare Office of Corporate Compliance. Contractor acknowledges that any violation of the compliance plan

can, at the sole discretion of the University; result in the immediate termination of this contract upon written notice to the Contractor. The Contractor recognizes that it is under an affirmative obligation to immediately report to UK HealthCare's Corporate Compliance Officer any actions by an agent or employee of UK HealthCare which Contractor believes, in good faith, violates any ethical, professional or legal standard.

Contractor will be required to comply with the Health Insurance Portability Accountability Act of 1996 (HIPAA). As a precondition of entering into a contract with the University, the Contractor will be required, as applicable, to complete a Business Associate Agreement for the purpose of complying with the Administrative Simplification provisions of HIPAA and regulations issued pursuant thereto. A Business Associate Agreement shall be incorporated herein by reference where applicable

Contractor shall comply with any and all applicable accreditation standards promulgated by the Joint Commission on the Accreditation of Healthcare Organizations (JCAHO), or such other accrediting organization as UK HealthCare is applicable, as the same now exist or are subsequently promulgated and said standards are hereby incorporated by reference.

In the event that the Contractor provides any patient care services as part of its duties under the contract, Contractor shall require any employee or subcontractor to meet and maintain any credentialing standards determined by UK HealthCare in its reasonable discretion to be applicable.

In the event that Contractor provides any patient cares services as part of its duties under the contract, Contractor shall maintain professional liability insurance in a minimum amount of $1,000,000 per person and $3,000,000 per occurrence on its employees providing said services and require any subcontractor providing said services to maintain such coverage.

39. Payment Card Industry – Data Security Standard Requirements (PCI-DSS):

Contractor shall be required to comply with the Gramm-Leach-Bliley Act (GLBA). To the extent any purchase includes services, including support, such that the provider of the service (defined in the GLBA as "Service Provider") may receive "customer information" through the course of contracted activities with the University, Service Provider agrees to the following additional terms and conditions:

(a) Throughout the term of this Agreement, Service Provider shall implement and maintain "appropriate safeguards", as that term is used in § 314.4(d) of the FTC Safeguard Rule, 16 C.F.R. § 314, for all "customer information," as that term is defined in 16 C.F.R. § 314.2(b), received by Service Provider pursuant to this Agreement.

(b) Service Provider shall promptly notify the University, in writing, of each instance of (i) unauthorized access to or use of any customer information that could result in substantial harm or inconvenience to a customer of the University or (ii) unauthorized disclosure, misuse, alteration, destruction or other compromise of any customer information. Within 30 days of the termination or expiration of this Agreement, Service Provider shall destroy all records, electronic or otherwise, in its or its agents' possession that contains such customer information and shall deliver a written certification of the destruction to the University.

(c) Service provider consents, upon reasonable advance notice, to University's right to conduct an on-site audit of Service Provider's security program.

(d) Notwithstanding any other provisions of this Agreement, University may terminate this Agreement for cause if Service Provider has allowed a material breach of its security program, if Service Provider has lost or materially altered customer information, or if the University reasonably determines that Service Provider's security program is inadequate.

(e) Service Provider shall defend, indemnify, and hold harmless University, its agents, officers, board members, and employees from and against any and all claims, damages, losses, and expenses, including reasonable attorney's fees, for any claims arising out of or in any way relating to any allegations of security breaches, violations of the Safeguard Rule caused by Service Provider's negligence, intentional acts or omissions, or any loss or material alteration of customer information.

(f) Service Provider shall reimburse the University for any damages, including but not limited to any costs required to reconstruct lost or altered information, resulting from any security breach, loss, or alteration of customer information.

Contractor hereby agrees as follows:

(a) Contractor shall be responsible for the security of cardholder data that it possesses, even temporarily, including any functions relating to storing, processing, and transmitting of cardholder data on behalf of the University of Kentucky. In the case of a payment processing system and/or equipment purchased from Contractor that is covered by PA DSS (Payment Application Data Security Standard), Contractor warrants and represents that its software and/or equipment shall not impede the University's PCI DSS (Payment Card Industry Data Security Standard) compliance efforts. In the event that Contractor's software and/or equipment does impede such efforts, the University may, in its sole discretion, upon thirty (30) days' notice and opportunity to cure, terminate this Agreement, with any prepaid amounts refunded to University on a pro-rata basis.

(b) Contractor warrants and represents that, as of the effective date of this Agreement, it has complied with all applicable requirements for validation and compliance with the PCI DSS (Payment Card Industry Data Security Standard), as appropriate for its Service Provider level. Contractor agrees to supply the current status of its PCI DSS compliance, and evidence of its most recent validation of compliance, upon execution of this Agreement. Further, Contractor must supply to the University a new status report and evidence of validation of compliance at least annually and upon request by the University. Contractor will immediately notify the University if it learns that it is no longer PCI DSS compliant and will immediately report to the University the steps being taken to remediate the non-compliance status. In no event should Contractor's notification to the University be later than seven (7) calendar days after Contractor learns it is no longer PCI DSS compliant. Failure to maintain PCI DSS compliance shall be a breach of contract and the University may, at its sole discretion, terminate this Agreement if Contractor does not become compliant within thirty (30) days, with any prepaid amounts refunded to University on a pro-rata basis.

(c) Contractor warrants and represents that, as of the effective date of this Agreement; it has complied with all applicable requirements for validation with the PA DSS (Payment Application Data Security Standard) for its payment processing system. Contractor agrees to supply evidence of its most recent validation upon execution of this Agreement. Further, Contractor agrees to maintain PA DSS validation for the installed payment processing system version throughout the term of any maintenance agreement with the University. If the PA DSS validation deadline for the payment system lapses, Contractor acknowledges that it shall be in breach of this Agreement and the University may, at its sole discretion, terminate this Agreement if Contractor does not become

compliant within thirty (30) days, with any prepaid amounts refunded to University on a pro-rata basis.

(d) While doing business in University facilities or on its property, if credit card payments will be processed over the internet via the Contractors own system and/or equipment and through its own merchant account, Contractor will provide its own internet connection to process such payments and will not be permitted to use the University network and equipment.

40. Kentucky's Personal Information Security and Breach Investigation Procedures and Practices Act:

To the extent Company receives Personal Information as defined by and in accordance with Kentucky's Personal Information Security and Breach Investigation Procedures and Practices Act, KRS 61.931, 61.932 and 61.933 (the "Act"), Company shall secure and protect the Personal Information by, without limitation: (i) complying with all requirements applicable to non-affiliated third parties set forth in the Act; (ii) utilizing security and breach investigation procedures that are appropriate to the nature of the Personal Information disclosed, at least as stringent as University's and reasonably designed to protect the Personal Information from unauthorized access, use, modification, disclosure, manipulation, or destruction; (iii) notifying University of a security breach relating to Personal Information in the possession of Company or its agents or subcontractors within seventy-two (72) hours of discovery of an actual or suspected breach unless the exception set forth in KRS 61.932(2)(b)2 applies and Company abides by the requirements set forth in that exception; (iv) cooperating with University in complying with the response, mitigation, correction, investigation, and notification requirements of the Act , (v) paying all costs of notification, investigation and mitigation in the event of a security breach of Personal Information suffered by Company; and (vi) at University's discretion and direction, handling all administrative functions associated with notification, investigation and mitigation.

41. Disaster Recovery:

At the University's request, Contractor shall prepare and submit to University for its acceptance and approval, a comprehensive disaster recovery and business resumption plan, detailing Contractor's in-place procedures for daily back-up of data and systems, storage and protection of back-up media, and contingency plans and other details regarding Contractor's disaster recovery and business resumption plan.

At least as often as once per year and at Contractor's sole cost and expense, Contractor will undertake a comprehensive test of its disaster recovery and business resumption plans. Contractor will share all records, reports, internal or external audits, documentation, and all other materials regarding such testing with University.

- **Source Code Escrow**

Contractor agrees that if Contractor is licensing, selling, renting, leasing or otherwise providing any software to University, or creating, modifying, customizing or developing any software for University under the Agreement, that Contractor will at all times during the Term of the Agreement, at its sole cost and expense, maintain the source code (and any and all updates, enhancements, changes or additions thereto) for such software in escrow, with a third party escrow agent acceptable to University.

Contractor agrees that the source code shall be placed in escrow and released to University in the event that Contractor fails to meet its obligations to University under the Agreement, fails to support the

software as required under the Agreement, materially breaches the Agreement, or suffers an event of bankruptcy (collectively "Release Events").

- **Encryption**

Contractor agrees to ensure the confidentiality and integrity of University Data in storage and in transit through the implementation of strong encryption controls that are acceptable to the University. If Contractor determines that strong encryption of University Data is not appropriate, Contractor must apply compensating controls, approved by University, to ensure the confidentiality and integrity of University Data and document the rationale for the approach taken.

- **Retention**

Immediately upon termination, cancellation or expiration of the Agreement for any reason unless Contractor is otherwise instructed by University, or upon University's written request at any time, Contractor shall return or remove and destroy any and all University Data in whatever form or medium in Contractor's possession or control of Contractor or its agents or subcontractors, and certify such complete and full return or removal and destruction of all University Data in writing.

Contractor agrees to retain data for the appropriate statutory requirements. Contractor further agrees to extend to the retained data any and all protections, limitations, and restrictions contained in the Contract and any addenda or exhibits thereto and the Business Associate Agreement between University and Contractor, and to limit any further uses and disclosures of the retained data to the purposes of the appropriate statutory requirements for so long as Contractor retains University Data. Contractor agrees that any retained data will be destroyed at the expiration of such period according to University's direction.

Contractor's obligations under this Section shall survive the expiration or termination of this Agreement for any reason.

- **Offshoring**

Contractor shall not transmit, export, download, store, or maintain any University Data beyond the borders of the United States of America.

42. Payment Terms:

The University adheres to a strategic approach regarding payables management based on risk minimization, processing costs, and industry best practices. As such, suppliers and individuals doing business with the University will be paid based on the following protocol:

1. The University utilizes Payment Plus (e-payables) as its primary default form of payment. By enrolling in Payment Plus, suppliers can receive payments immediately (all invoices will be paid immediately upon confirmation of goods receipt and invoice). The process is electronic and the supplier receives real-time payment notices. Additional information regarding Payment Plus (and enrollment form) can be found at: https://www.uky.edu/ufs/payment-plus-supplier-enrollment-form.

2. Payments by check. Payment terms for check payments are Net-30.

3. Individuals receiving payments from the University that require ACH direct payments will only be processed under special circumstances as approved by the Controller's office. Payment terms for ACH are Net-40.

Revised September 28, 2022

Specification Index

Item No.	Item Rev.	Package No.	Package Rev.	Description	Reference No.
				Substation Warranty	Closeout
				Substation O&M	Closeout

Drawing Index

SECTION 261116 - SECONDARY UNIT SUBSTATIONS

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 indoor secondary unit substations delivered to the site. It also includes testing and factory startup, consisting of the following:

1. Primary incoming section.
2. Transformer. See specification 261200 – Medium Voltage Transformers for additional requirements.
3. Secondary distribution section.
4. Testing
5. Factory Startup

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories.

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. Dimensioned plans and elevations showing major components and features.
3. One-line diagram.
4. List of materials.
5. Nameplate legends.
6. Size and number of bus bars and current rating for each bus, including mains and branches of phase, neutral, and ground buses.
7. Short-time and short-circuit current ratings of secondary unit substations and components.
8. Ratings of individual protective devices.

C. Time-Current Characteristic Curves: For overcurrent protective devices.

D. Primary Fuses: Submit recommendations and size calculations.

E. Coordination Drawings: Reflected ceiling plans, 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. Dimensioned concrete base, outline of secondary unit substation, conduit entries, and ground rod locations.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain secondary unit substation through one source from a single manufacturer.

B. Comply with IEEE C2.

C. Comply with IEEE C37.121.

D. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver in shipping splits in sizes that can be moved past obstructions in delivery path.

B. Coordinate delivery of secondary unit substations to allow movement into designated space.

1.6 PROJECT CONDITIONS

A. Field Measurements: Indicate measurements on Shop Drawings.

B. Space Limitations: **Equipment must fit within a footprint of 45'-4" x 6'-4" x 8'-6" (WxDxH)**.

C. The entire unit substation assembly is to be front access only.

D. Service Conditions: IEEE C37.121, usual service conditions, except for the following:

1. Exposure to significant solar radiation.
2. Altitudes above 3300 feet (1000 m).
3. Exposure to fumes, vapors, or dust.
4. Exposure to explosive environments.
5. Exposure to hot and humid climate or to excessive moisture, including steam, salt spray, and dripping water.
6. Exposure to seismic shock or to abnormal vibration, shock, or tilting.
7. Exposure to excessively high or low temperatures.
8. Unusual transportation or storage conditions.
9. Unusual grounding resistance conditions.
10. Unusual space limitations.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Spare fuses: Six of each type and rating of fuse and fusible device used, except for medium-voltage fuses. Include spares for the following:

    a. Primary disconnect fuses.
    b. Potential transformer fuses.
    c. Control power fuses.
    d. Fuses and fusible devices for fused circuit breakers.
    e. Fuses for secondary fusible devices.

2. Spare Indicating Lights: Six of each type installed.
3. Touchup Paint: Three half-pint containers of paint matching enclosure's exterior finish.
4. Primary Switch Contact Lubricant: One container(s).
5. One set(s) of spare mounting gaskets for bushings, handholes, and the gasket between relief cover and flange of pressure relief device.
6. Two spare sets of key interlock key sets complete.

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:

1. ABB Control, Inc.

2. Cooper Industries, Inc.; Cooper Power Systems Division.
3. Eaton.
4. Siemens Energy & Automation, Inc.
5. Square D; Schneider Electric.

2.2 MANUFACTURED UNITS

A. Indoor Unit Arrangement: Single assembly. Complete, assembled unit – including the air switch, transformer, and distribution must fit into space as indicated on the contract documents.

B. Enclosure Finish: Factory-applied finish in manufacturer's standard color, including under surfaces treated with corrosion-resistant undercoating.

C. Access: Front access only.

2.3 INCOMING SECTIONS

A. Primary Incoming Section: Enclosed, air-interrupter, primary switch.

1. Three pole, single throw, dead front, bottom feed, metal enclosed, with manual stored energy operator, with fuses mounted on a single frame, complying with IEEE C37.20.3.
2. Key interlocking system to prevent fuse access door from being opened unless switch is open. Additionally, interlock air-interrupter switch with transformer secondary main circuit breaker, preventing switch from being opened or closed unless secondary main circuit breaker is open.
3. Phase Barriers: Located between blades and fuses of each phase, designed for easy removal, allows visual inspection of switch components when barrier is in place.
4. Window: Permits viewing switch-blade positions when door is closed.
5. Accessory Set: Tools and miscellaneous items required for interrupter switchgear test, inspection, maintenance, and operation. Include fuse-handling tool as recommended by switchgear manufacturer.
6. Continuous-Current Rating: 600 A copper.
7. Short-Circuit Rating:

    a. Short-time momentary asymmetrical fault rating of 40 kA.
    b. 3-second symmetrical rating of 25-kA RMS.
    c. Fault close asymmetrical rating of 40 kA.

8. Fuses: Sizes recommended by secondary unit substation manufacturer, considering fan cooling, temperature-rise specification, and cycle loading. Comply with the following:

    a. Current-limiting type, rated for not less than 50-kA RMS symmetrical current-interrupting capacity.
    b. Indicator integral with each fuse to show when it has blown.
    c. Spares: Include three fuses in use and three spare fuses in storage clips in each switch.

9. Cable Entry: Include a cabling entry terminal space on side of switch to facilitate entry of primary conductors.

10. Surge Arresters: Comply with IEEE C62.11, Distribution class; metal-oxide-varistor type, with ratings as indicated, connected in each phase of incoming circuit and ahead of any disconnecting device.

2.4 LIQUID-FILLED TRANSFORMER SECTION

A. Description: IEEE C57.12.00 and UL 1062, liquid-filled, two-winding, secondary unit substation transformer.

B. Winding material: Copper

C. Insulating Liquid:
   1. Less flammable, edible-seed-oil based, and listed and labeled by a qualified electrical testing laboratory as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested in accordance with ASTM D92. Liquid must be biodegradable and nontoxic.

D. Insulation Temperature Rise:

   1. 55 deg C, based on an average ambient temperature of 86 deg F (30 deg C) over 24 hours with a maximum ambient temperature of 104 deg F (40 deg C). Insulation system must be rated to continuously allow an additional 12-percent kVA output, at 65 deg C temperature rise, without decreasing rated transformer life.

E. BIL: 95 kV for primary and 30 kV for secondary.

F. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

G. Provide with vibration isolation for reduced sound transmission through structure.

H. Full-Capacity Voltage Taps: Four nominal 2.5 percent taps, two above and two below rated primary voltage; with externally operable tap changer for de-energized use and with position indicator and padlock hasp.

I. Cooling System: Class ONAN/ONAF/ONAF, liquid cooled, and with provisions for future forced-air rating. Cooling systems must include auxiliary cooling equipment, automatic controls, and status indicating lights.

J. Impedance: 5%.

K. Accessories: Grounding pads, lifting lugs, and provisions for jacking under base. Transformers must have a steel base and frame allowing use of pipe rollers in any direction, and an insulated, low-voltage, neutral bushing with removable ground strap. Include the following additional accessories:

   1. Liquid-level gage.
   2. Pressure-vacuum gage.
   3. Liquid temperature indicator.
   4. Drain and filter valves.
   5. Pressure-relief device.

2.5 SECONDARY DISTRIBUTION SECTION

A. Front-Connected, Front-Accessible Switchboards:

   1. Main Devices: Fixed, individually mounted.
   2. Branch Devices: Panel mounted.
   3. Sections front and rear aligned.
   4. Bus rating: 65KAIC

B. Indoor Enclosures: Steel, NEMA 250, Type 1.

C. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

D. Barriers: Between adjacent switchboard sections.

E. Isolation for main bus of main section and main and vertical buses of feeder sections.

F. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

G. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

H. Pull Box on Top of Switchboard (if required):

1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
2. Set back from front to clear circuit-breaker removal mechanism.
3. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
4. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
5. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.

I. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated, with tin-plated aluminum or copper feeder circuit-breaker line connections.
2. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with compression connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
3. Ground Bus: 1/4-by-2-inch- (6-by-50-mm-) Minimum-size required by UL 891 unless otherwise noted, hard-drawn copper of 98 percent conductivity, equipped with compression connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
4. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
5. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with compression connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
6. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

J. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

K. PLC AUTOMATIC MAIN-TIE-MAIN SYSTEM

1. The system shall be PLC-controlled automatic throw-over system. In normal operation, each main shall be closed and the tie switch open. If one of the mains loses power, the main shall open and the tie breaker shall close (hold in alternate source). When power returns, the main shall remain open until it is manually transferred back by the users. This process would also remain the same for the second main. If the system is holding in the alternate power, and power has been restored to the open main, and the active main opens, it shall transfer back to the opposite main while keeping the tie breaker closed.

2. The system shall have control and monitoring by a touchscreen HMI with a BACNet interface for remote monitoring. Provide full BACNet interface, point naming, etc. and connection to BAS BACNet system.

3. In addition to the automatic transfer sequence the system shall also have the following user selected options controllable by key switches:
   a. Manual/Automatic Operation
   b. Open/Closed Transition Transfer
   c. Auto Retransfer/Hold in Alternate
   d. A 3-position test switch (Main One, Off, Main Two).

4. The system shall also have the following indicator lights. Indicator lights shall be LED type.
   a. Auto
   b. Manual
   c. Auto Failure
   d. Source One Available
   e. Source Two Available
   f. Source One Open (green indicator light)
   g. Source One Closed (red indicator light)
   h. Source One Fault
   i. Source Two Open (green indicator light)
   j. Source Two Closed (red indicator light)
   k. Source Two Fault
   l. Tie Breaker Open (green indicator light)
   m. Tie Breaker Closed (red indicator light)
   n. Tie Breaker Fault.

2.6 TRANSIENT VOLTAGE SUPPRESSION DEVICES

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. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. ABB.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Surge Protection Device Description: IEEE C62.41-compliant, integrally or separately mounted, bolt-on, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the switchboard short-circuit rating, and with the following features and accessories:

1. Fuses, rated at 200-kA interrupting capacity.
2. Fabrication using bolted compression lugs for internal wiring.
3. Integral disconnect switch.
4. Redundant suppression circuits.
5. Redundant replaceable modules.
6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
7. LED indicator lights for power and protection status.
8. Audible alarm, with silencing switch, to indicate when protection has failed.
9. Six-digit, transient-event counter set to totalize transient surges.

C. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase.

D. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.

E. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277V and 208Y/120V, three-phase, four-wire circuits shall be as follows:

1. Line to Neutral: 800 V for 480Y/277 and 400 V for 208Y/120.
2. Line to Ground: 800 V for 480Y/277 and 400 V for 208Y/120.
3. Neutral to Ground: 800 V for 480Y/277 and 400 V for 208Y/120.

2.7 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Electronic trip circuit breakers with RMS sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

a. Instantaneous trip.
b. Long- and short-time pickup levels.
c. Long- and short-time time adjustments.
d. Ground-fault pickup level, time delay, and I^2t response.
e. Provide remotely controlled circuit breakers where indicated on drawings.

2.8 INSTRUMENTATION

A. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:

1. Potential Transformers: IEEE C57.13; 120 V, 60 Hz, single secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
2. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; wound type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.

B. Multifunction Digital-Metering Monitor:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work are:
a. Schneider PM5563 (or Schneider PM5563RD for remote display)
b. Eaton PXM2000 (or Eaton PXM2000T for remote display)
c. Shark 250 with PROTOCOM BACnet Gateway Kit.

2. The meter shall have a BACnet interface.
3. Communications interface to the BAS for providing output of all monitored and stored information to the owner's facility management system. Coordinate with BAS installer to provide the required hardware and accessories. **Provide all necessary communication cabling and connections to establish this connection.**
4. Mounting: Display and control unit flush or semi-flush mounted in instrument compartment door. **Mounting height for the meter shall be no higher than 5 feet above finished floor.**
5. Separately mounted molded case circuit breaker for meter protection and isolation.

2.9 CONTROL POWER

A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.

B. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

C. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.10 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

C. Portable Circuit-Breaker Lifting Device: Floor-supported, roller-based, elevating carriage arranged for movement of circuit breakers in and out of compartments for present and future circuit breakers.

D. Spare-Fuse Cabinet: Suitably identified, wall-mounted, lockable, compartmented steel box or cabinet. Arrange for wall mounting.

2.11 IDENTIFICATION

A. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 IDENTIFICATION

A. Operating Instructions: Frame printed operating instructions for secondary unit substations, including key interlocking, control sequences, elementary single-line diagram, and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of secondary unit substation.

B. Compartment Nameplates: Engraved, laminated-plastic or metal nameplate for each compartment, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

A. Testing: Engage manufacturer’s certified technician to perform tests.

3.3 FOLLOW-UP SERVICE

A. Voltage Monitoring and Adjusting: After Substantial Completion, if requested by Owner, but not more than six months after Final Acceptance, perform the following voltage monitoring:

1. During a period of normal load cycles as evaluated by Owner, perform seven days of three-phase voltage recording at the outgoing section of each secondary unit substation. Use voltmeters with calibration traceable to the National Institute of Science and Technology standards and with a chart speed of not less than 1 inch (25 mm) per hour. Voltage unbalance greater than 1 percent between phases, or deviation of any phase voltage from the nominal value by more than plus or minus 5 percent during the test period, is unacceptable.

2. Corrective Action: If test results are unacceptable, perform the following corrective action, as appropriate:

    a. Adjust transformer taps.
    b. Rebalance loads.
    c. Prepare written request for voltage adjustment by electric utility.

3. Retests: Repeat monitoring, after corrective action has been performed, until satisfactory results are obtained.
4. Report: Prepare a written report covering monitoring performed and corrective action taken.

B. Infrared Scanning: Perform as specified in Division 26 Section "Medium-Voltage Switchgear."

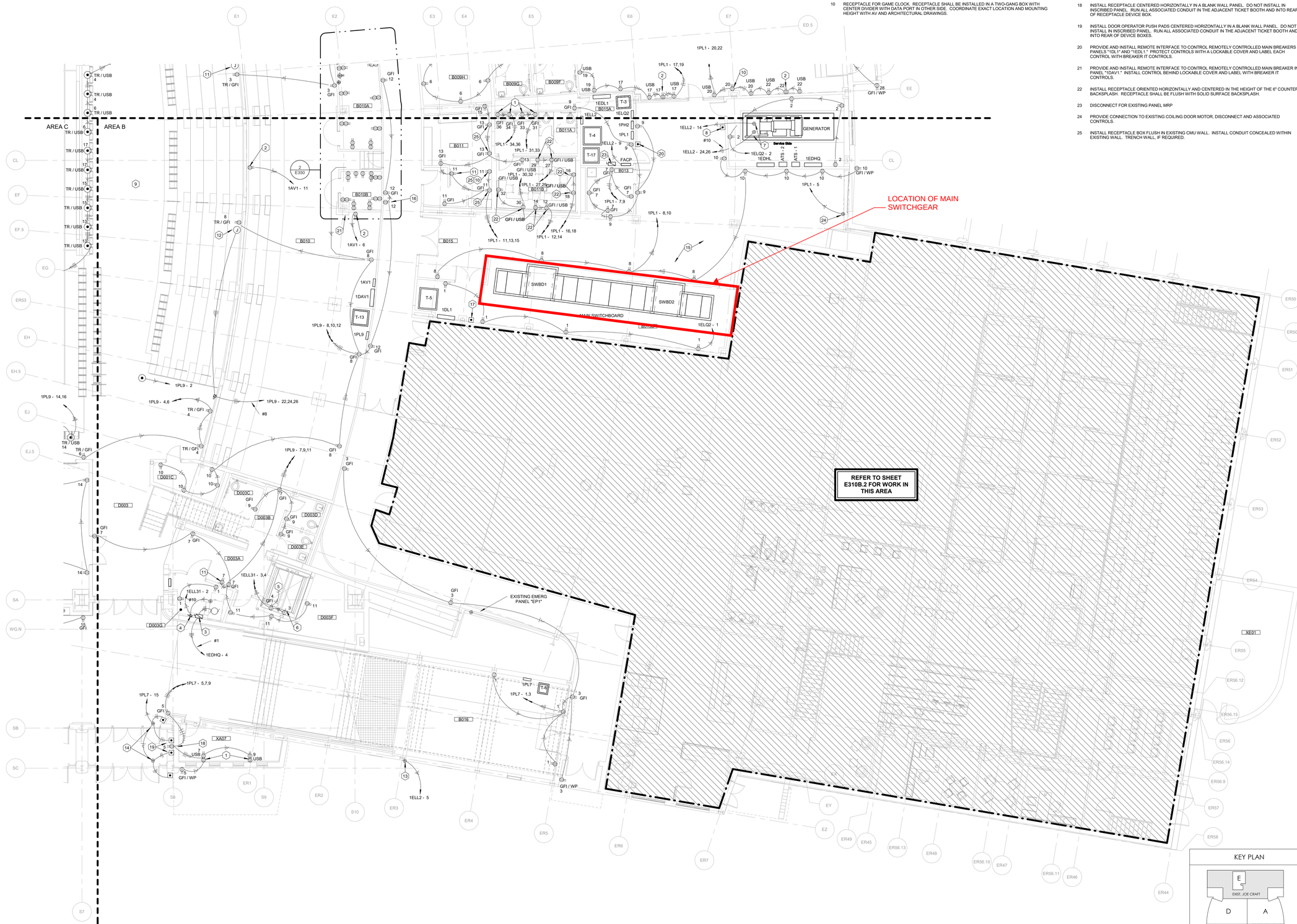
3.4 DEMONSTRATION

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

END OF SECTION 261116

ROOM SCHEDULE: EVENT LEVEL	
ROOM NUMBER	ROOM NAME
A000C	CORRIDOR
A000D	CORRIDOR
A009	IT STORAGE
A010	COACHES LOUNGE
A010A	SHOWER
A010B	SHOWER
A011	CUST.
A012	WOMEN'S CORRIDOR
A012A	FILM ROOM
A012B	WOMEN'S LOUNGE
A012C	WOMEN'S LOCKER ROOM
A012D	WOMEN'S TOILET
A012E	SHOWERS
A013	OFFICIALS LOCKER ROOM
A013A	WOMEN'S TOILET
A013B	MEN'S TOILET
A014B	TOILET
A014C	FITNESS ROOM
A017	GYMNASTICS LOCKER ROOM
A017A	GYMNASTICS SHOWERS/ RESTROOM
A017B	GYMNASTICS TEAM LOUNGE
A017C	GYMNASTICS EQUIPMENT ROOM
A017D	VESTIBULE
A019	VOLLEYBALL TEAM LOCKER ROOM
A019A	VESTIBULE
A019B	VOLLEYBALL TEAM LOUNGE
A019C	VOLLEYBALL SHOWERS/ RESTROOM
A021	NUTRITION STORAGE
A023	IDF
A025	VOLLEYBALL EQUIPMENT STORAGE
B000A	CORRIDOR
B000C	CORRIDOR
B000D	RAMP
B001	MECHANICAL
B003B	UNASSIGNED SHELL SPACE
B005	STUNT TEAM LOUNGE
B005A	STUNT TEAM RESTROOM
B005A	STAFF LOCKER ROOM
B005B	STAFF LOCKER ROOM
B005B	STORAGE
B005C	STUNT TEAM LOCKER ROOM
B007A	STAFF LOCKER ROOM
B009	MEDIA HOSPITALITY ROOM
B009A	MEDIA CORRIDOR
B009B	MEDIA PHOTOGRAPHY ROOM
B009C	MEDIA
B009C-1	IDF
B009D	MEDIA CORRIDOR
B009E	VESTIBULE
B009F	MEN'S RESTROOM
B009G	WOMEN'S RESTROOM
B009H	MEDIA STORAGE
B010	UNDER BLEACHER STORAGE
B010A	IDF
B010A	IDF
B010B	AV
B011	DANCE LOCKER/CUBBIES
B011A	DANCE TEAM RESTROOM
B011B	DANCE TEAM
B013	CUSTODIAL
B015	UK AD OPS WORK ROOM
B015	UK AD OPS WORK ROOM
B015A	ELECTRICAL
B015C	UK AD OPS RECEIVING
B015D	TRANSFORMER
B015D	GENERATOR
B016	MECHANICAL
B055	CORRIDOR
B055	CORRIDOR
B109A	IDF
C000	LOBBY
C000A	VESTIBULE
C000B	RECEPTION
C00C	CORRIDOR
C000D	CORRIDOR
C000E	CORRIDOR
C001	OFFICE
C002	STUDY
C003	OFFICE
C004	STUDY
C005	OFFICE
C006	STUDY
C007	CONFERENCE ROOM
C008	OFFICE
C009	COUNSELORS OFFICE
C010	OFFICE
C011	COUNSELORS OFFICE
C012	OFFICE
C013	COUNSELORS OFFICE
C014	GROUP ROOM
C014A	STORAGE
C015	COUNSELORS OFFICE
C016	STUDY ROOM
C017	BREAK ROOM
C018	STUDY ROOM
C020	LOUNGE/ CHECK IN
C020A	RECEPTION
C020B	COPY
C022	CORRIDOR
C022A	ELECTRICAL
C022B	MEN'S RESTROOM
C022C	CUSTODIAL
C024	CORRIDOR
C024A	WOMEN'S RESTROOM
C026	COMPUTER LAB
C026A	STORAGE
C027	INTERN OFFICE
C028	COUNSELORS OFFICE
C029	INTERN OFFICE
C030	GRAD ASSIST OFFICE
C031	INTERN OFFICE
C032	COUNSELORS OFFICE
C033	INTERN OFFICE
C034	COUNSELORS OFFICE
C035	INTERN OFFICE
C036	IDF
C040	QUIT STUDY
C042	GROUP LEARNING
C042A	CORRIDOR
C044	DIRECTOR'S OFFICE
C046	ASSISTANT AD OFFICE
C048	STORAGE
C130	ELEVATOR CONTROL ROOM
D000	LOBBY
D001	EVENT FLOOR
D001B	STORAGE
D001C	STORAGE
D002	COURT LOBBY
D002A	ELEVATOR LOBBY
D002B	CORRIDOR
D002C	TOILET
D002D	TOILET
D002E	TOILET
D002F	MACHINE ROOM
D002G	STORAGE
D003	COURT LOBBY
D003A	ELEVATOR LOBBY
D003B	CORRIDOR
D003C	TOILET
D003D	TOILET
D003E	TOILET
D003F	STORAGE
D003G	MACHINE ROOM
D010A	WEST EVENT BOWL
D010B	EAST EVENT BOWL
E000A	CORRIDOR
E000B	RAMP
E000C	CORRIDOR
E000E	CORRIDOR
E000F	RAMP
E001	EVENT/UK AD OPS STORAGE
E003	MECHANICAL
E003A	MECHANICAL
E003B	IDF
E005	VISITING TEAM COACH MTG. ROOM
E006	UNDER BLEACHER STORAGE
E006A	AV
E006B	IDF
E007	MBBALL COACH LOCKER ROOM LOUNGE
E007A	MBBALL COACH LOCKER ROOM
E007B	MBBALL COACH RESTROOM
E007D	MBBALL COACH SHOWER ROOM
E008	MECHANICAL/ ELECTRICAL
E011	CUSTODIAL
E015	CREATIVE CONTENT STORAGE
E018	STORAGE
E026	WORK ROOM
E027	AD OPS OFFICE
E028	WOMEN'S RESTROOM
E029	AD OPS OFFICE
E030	AD FILE & ARCHIVE STORAGE
E031	AD OPS OFFICE
E032	MEN'S RESTROOM
E033	AD OPS OFFICE
E034	CHEER/DANCE STORAGE
E035	AD OPS OFFICE
E037	CHEER/DANCE OFFICE
E038	WOMEN'S BASKETBALL STORAGE
E038A	WOMEN'S BASKETBALL STORAGE
E039	CHEER/DANCE OFFICE
E041	CHEER/DANCE OFFICE
E042	VOLLEYBALL STORAGE
E044	MEN'S BASKETBALL STORAGE
E044A	OFFICE
E044B	MECHANICAL
E045	VISITING TEAM LOCKER ROOM

ROOM SCHEDULE: EVENT LEVEL	
ROOM NUMBER	ROOM NAME
E045B	VISITING TEAM RESTROOM
E045C	VISITING TEAM ICE ROOM
E045D	VISITING TEAM SHOWER ROOM
E047	VISITING TEAM TRAINING ROOM
EL00-B	ELEVATOR
EL00-C	ELEVATOR
EL-A	ELEVATOR
PC01	CHASE
ST-C	STAIR
ST-D	STAIR
ST-E	STAIR
ST-F	STAIR
XA01	SATELLITE TICKET OFFICE
XA07	SATELLITE TICKET OFFICE
XE01	EXTERIOR MECHANICAL ENCLOSURE



CODED NOTES:

1. INSTALL RECEPTACLES 2" ABOVE BACKSPLASH/COUNTER. REFER TO ARCHITECTURAL DRAWINGS AND APPROVED CASEWORK SHOP DRAWINGS.
2. PROVIDE AND INSTALL RECEPTACLE FOR BROCAST CABLING ENCLOSURE. REFER TO AV DRAWINGS FOR ADDITIONAL INFORMATION.
3. 100A/3P/600V DISCONNECT WITH DRY AND ISOLATED CONTACTS FOR BATTERY LOWERING. FUSE WITH 80 AMP DUAL ELEMENT TIME DELAY FUSES. PROVIDE CONNECTION TO ELEVATOR CONTROLLER.
4. 30A/2P/240V DISCONNECT. FUSED AT 20 AMPS. PROVIDE CONNECTION TO ELEVATOR CONTROLLER.
5. CONTINUE CIRCUIT TO LIGHT FIXTURE IN ELEVATOR PIT. RECEPTACLE AND LIGHT TO BE ON THE SAME CIRCUIT. REFER TO LIGHTING PLANS.
6. DEDICATED SIMPLEX RECEPTACLE FOR SUMP PUMP IN ELEVATOR PIT. REFER TO PLUMBING DRAWINGS FOR EXACT LOCATION.
7. CONNECT GENERATOR BATTERY CHARGER AND JACKET HEATER CIRCUITS.
8. INSTALL GENERATOR REMOTE ANNUNCIATOR/EMERGENCY STOP AT THIS LOCATION.
9. ALL RECEPTACLES IN THE EVENT FLOOR/GYMNASIUM/ARENA ARE TO BE TAMPERPROOF TYPE.
10. RECEPTACLE FOR GAME CLOCK. RECEPTACLE SHALL BE INSTALLED IN A TWO-GANG BOX WITH CENTER DIVIDER WITH DATA PORT IN OTHER SIDE. COORDINATE EXACT LOCATION AND MOUNTING HEIGHT WITH AV AND ARCHITECTURAL DRAWINGS.

CODED NOTES:

11. INSTALL RECEPTACLE FOR FLAT PANEL DISPLAY. REFER TO ARCHITECTURAL DRAWINGS FOR HEIGHT OF FLAT PANEL DISPLAY. COORDINATE WITH INSTALLER.
12. TERMINATE CIRCUIT IN A JUNCTION BOX FOR CONNECTION TO MOTORIZED BLEACHER SYSTEM. COORDINATE REQUIREMENTS WITH APPROVED SHOP DRAWINGS AND PROVIDE CIRCUIT AS REQUIRED. PROVIDE FINAL CONNECTION TO SINGLE-POINT BLEACHER CONNECTION.
13. PROVIDE 120V CONNECTION TO SPRINKLKER GONG, AS REQUIRED. COORDINATE WITH SPRINKLER CONTRACTOR PRIOR TO ROUGH-IN. CONNECT TO NEAREST 120V CONVENIENCE RECEPTACLE CIRCUIT.
14. MAKE CONNECTIONS TO HANDICAP DOOR OPERATORS AND WALL-MOUNTED PUSH PADS. COORDINATE EXACT LOCATIONS WITH ARCHITECTURAL DRAWINGS. CONCEAL CONDUITS.
15. ELECTRICAL PRIMARY WILL HAVE TO CROSS THE EXISTING UTILITY TUNNEL IN THIS APPROIMATE LOCATION. PROVIDE CONDUIT SUPPORTS, AS REQUIRED.
16. RECEPTACLE FOR DUAL-FACE CLOCK. INSTALL AT ELEVATION SUCH THAT CLOCK WILL BE 4" BELOW CEILING. PROVIDE AND INSTALL DUAL-FACE CLOCK PER SPECIFICATIONS.
17. PROVIDE AND INSTALL REMOTE INTERFACE TO CONTROL REMOTELY CONTROLLED MAIN, TIE, MAIN, AND THREE BRANCH BREAKERS IN "SWBD1" AND "SWBD2" AT THIS LOCATION. INSTALL CONTROLS BEHIND A LOCKABLE COVER AND LABEL EACH CONTROL WITH BREAKER IT CONTROLS.
18. INSTALL RECEPTACLE CENTERED HORIZONTALLY IN A BLANK WALL PANEL. DO NOT INSTALL IN INSCRIBED PANEL. RUN ALL ASSOCIATED CONDUIT IN THE ADJACENT TICKET BOOTH AND INTO REAR OF RECEPTACLE DEVICE BOX.
19. INSTALL DOOR OPERATOR PUSH PADS CENTERED HORIZONTALLY IN A BLANK WALL PANEL. DO NOT INSTALL IN INSCRIBED PANEL. RUN ALL ASSOCIATED CONDUIT IN THE ADJACENT TICKET BOOTH AND INTO REAR OF DEVICE BOXES.
20. PROVIDE AND INSTALL REMOTE INTERFACE TO CONTROL REMOTELY CONTROLLED MAIN BREAKERS IN PANELS "1DL1" AND "1EDL1." PROTECT CONTROLS WITH A LOCKABLE COVER AND LABEL EACH CONTROL WITH BREAKER IT CONTROLS.
21. PROVIDE AND INSTALL REMOTE INTERFACE TO CONTROL REMOTELY CONTROLLED MAIN BREAKER IN PANEL "1DAV1." INSTALL CONTROL BEHIND LOCKABLE COVER AND LABEL WITH BREAKER IT CONTROLS.
22. INSTALL RECEPTACLE ORIENTED HORIZONTALLY AND CENTERED IN THE HEIGHT OF THE 6" COUNTER BACKSPLASH. RECEPTACLE SHALL BE FLUSH WITH SOLID SURFACE BACKSPLASH.
23. DISCONNECT FOR EXISTING PANEL MRP.
24. PROVIDE CONNECTION TO EXISTING COILING DOOR MOTOR, DISCONNECT AND ASSOCIATED CONTROLS.
25. INSTALL RECEPTACLE BOX FLUSH IN EXISTING CMU WALL. INSTALL CONDUIT CONCEALED WITHIN EXISTING WALL. TRENCH WALL, IF REQUIRED.

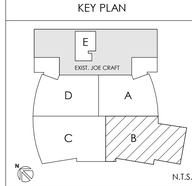
NOTE:

IT IS NOT INTENDED THAT THE PLANS SHOW ALL OFFSETS IN PIPES, CONDUITS, AND DUCTS REQUIRED FOR INSTALLATION OF THE WORK. DETAILS AND SECTIONS ARE INCLUDED FOR SOME AREAS TO SHOW INTENDED RELATIONSHIP OF THE WORK OF VARIOUS TRADES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND SUB-CONTRACTORS TO COORDINATE INSTALLATION OF THE WORK AND TO PROVIDE THE NECESSARY OFFSETS, TRANSFORMATIONS, AND FITTINGS REQUIRED. NO ADDITIONAL COMPENSATION WILL BE ALLOWED FOR CORRECTION CONFLICTS BETWEEN THE WORK OF VARIOUS TRADES. DETAILS AND SECTIONS ARE SHOWN FOR THE CONTRACTORS CONVENIENCEAND SHALL NOT BE CONSIDERED COMPLETE IN EVERY DETAIL.

EVENT LEVEL POWER PLAN - AREA B

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

KEY PLAN



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NOT FOR CONSTRUCTION

EVENT LEVEL POWER PLAN - AREA B

IMPROVE MEMORIAL COLISEUM
FOR:
THE UNIVERSITY OF KENTUCKY
LEXINGTON, KENTUCKY

Architect of Record:
Civil Engineer:
Landscape Architect:
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UK#: 2520.0
Project No: 1924
Drawn By: ND
Rev'd By: WT

ISSUED FOR:

REVISIONS

#	DATE	DESCRIPTION

CONSTRUCTION DOCUMENTS

E310B

EVENT LEVEL POWER PLAN - AREA B

DATE ISSUED:
JANUARY 23, 2023

SWITCH GEAR PANEL SCHEDULES

GENERAL NOTE:

1. PROVIDE COPY OF ALL COMPLETED PANEL SCHEDULES IN THE O & M MANUAL.
2. ALL A.I.C. RATINGS OF SWITCHBOARDS, DISTRIBUTION BOARDS, AND PANELBOARDS ARE TO MEET THE REQUIREMENTS/RECOMMENDATIONS OF THE FAULT CURRENT COORDINATION STUDY.

Branch Panel: 1AV1

Location: UNDER BLEACHER STORAGE B010 **Volts:** 120/208 Wye **A.I.C. Rating:** 14,000
Supply From: 1DAV1 **Phases:** 3 **Mains Type:** MLO
Mounting: SURFACE **Wires:** 4 **MCB/MLO Rating:** 100
Enclosure: TYPE 1

Notes:
PROVIDE WITH ISOLATED GROUND

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT
1	RECS - AV B010B	20 A	1	1000 VA	1000 VA		1	20 A	RECS - AV B010B	2
3	RECS - AV B010B	20 A	1		1000 VA	1000 VA	1	20 A	RECS - AV B010B	4
5	RECS - AV B010B	20 A	1			1000 VA	1000 VA	1	20 A	RECS - UNDER BLCR STR B010 (BOARDCAST...	6
7	RECS - AV B010B	20 A	1	1000 VA	0 VA		1	20 A	SPARE	8
9	RECS - AV B010B	20 A	1		1000 VA	0 VA	1	20 A	SPARE	10
11	RECS - UNDER BLEACHER STORAGE B010	20 A	1			1000 VA	0 VA	1	20 A	SPARE	12
13	SPARE	20 A	1	0 VA	0 VA		1	20 A	SPARE	14
15	SPARE	20 A	1		0 VA	0 VA	1	20 A	SPARE	16
17	SPARE	20 A	1			0 VA	0 VA	1	20 A	SPARE	18
19	SPARE	20 A	1	0 VA	0 VA		1	20 A	SPARE	20
21	SPARE	20 A	1		0 VA	0 VA	1	20 A	SPARE	22
23	SPARE	20 A	1			0 VA	0 VA	1	20 A	SPARE	24
		Total Load:		3000 VA	3000 VA	3000 VA				
		Total Amps:		25 A	25 A	25 A				

Notes:

Branch Panel: 1AV2

Location: UNDER BLEACHER STORAGE B010 **Volts:** 120/208 Wye **A.I.C. Rating:** 14,000
Supply From: 1DAV1 **Phases:** 3 **Mains Type:** MLO
Mounting: SURFACE **Wires:** 4 **MCB/MLO Rating:** 100
Enclosure: TYPE 1

Notes:
PROVIDE WITH ISOLATED GROUND

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT
1	MEDIA B009C (PROJECTOR & SCREEN)	20 A	1	180 VA	1000 VA		1	20 A	FLOOR BOX - ARENA BALCONY (AV ENCLOSURER)	2
3	RECS - MEDIA B009C (AV ENCLOSURER)	20 A	1		180 VA	1000 VA	1	20 A	RECS - EVENT FLOOR D001 (AV ENCLOSURER)	4
5	RECS - MEDIA B009C	20 A	1			1000 VA	1000 VA	1	20 A	RECS - MEDIA B009C (AUDIO INTERFACE)	6
7											8
9											10
11											12
13											14
15											16
17											18
19											20
21											22
23											24
		Total Load:		1180 VA	1180 VA	2000 VA				
		Total Amps:		10 A	10 A	17 A				

Notes:

Switchboard: SWBD1

Location: TRANSFORMER B015D **Volts:** 480/277 Wye **A.I.C. Rating:** 65,000
Supply From: **Phases:** 3 **Mains Type:** MCB
Mounting: CONCRETE PAD **Wires:** 4 **MCB/MLO Rating:** 2400
Enclosure: NEMA 1

Notes:
100% RATED MAIN BREAKER. SERVICE ENTRANCE RATED. MAIN AND TIE BREAKERS ARE TO BE REMOTELY OPERABLE.

CKT	Circuit Description	# of Poles	Trip Rating	Load	Remarks
1	AUTOMATIC TRANSFER SWITCH ATS - 1 - GENERATOR B015B	3	500 A	288483 VA	
2	AUTOMATIC TRANSFER SWITCH ATS - 2 - GENERATOR B015B	3	500 A	209213 VA	
3	PANEL 1PH13 - MECHANICAL B001	3	225 A	28224 VA	
4	TRANSFORMER T-5 (SUPPLIES PANEL 1DL1) - ELECTRICAL B015A	3	800 A	450133 VA	REMOTELY OPERABLE BREAKER
5	TRANSFORMER T-6 (SUPPLIES PANELS 1PL7) - MECHANICAL B016	3	50 A	9267 VA	
6	TRANSFORMER T-7 (SUPPLIES PANELS 1PL11) - MECHANICAL B001	3	125 A	21740 VA	
7	PANEL 4DH1 - ATTIC MEZZ. D300A	3	600 A	287070 VA	
8	TRANSFORMER T-13 (SUPPLIES 1DAV1) - UNDER BLEACHER STORAGE B010	3	400 A	233360 VA	
9	TRANSFORMER T-15 (SUPPLIES 2AV1) - CONCESSION STORAGE B102	3	70 A	35000 VA	
10	PANEL 1PH2	3	150 A	23200 VA	
11	SPARE	3	225 A	0 VA	
12	SPARE	3	150 A	0 VA	
13	SPARE	3	400 A	0 VA	
14	SPACE	1	--	--	
				1576892 VA	
				1897 A	

Notes:

Switchboard: SWBD2

Location: TRANSFORMER B015D **Volts:** 480/277 Wye **A.I.C. Rating:** 65,000
Supply From: **Phases:** 3 **Mains Type:** MCB
Mounting: CONCRETE PAD **Wires:** 4 **MCB/MLO Rating:** 2400
Enclosure: NEMA 1

Notes:
100% RATED MAIN BREAKER. SERVICE ENTRANCE RATED. MAIN AND TIE BREAKERS ARE TO BE REMOTELY OPERABLE.

CKT	Circuit Description	# of Poles	Trip Rating	Load	Remarks
1	TRANSFORMER T-17	3	350 A	150000 VA	
2	PANEL 1DH1 - UNDERBLEACHER STORAGE E006	3	800 A	373343 VA	REMOTELY OPERABLE BREAKER
3	TRANSFORMER T-14 (SUPPLIES 1AV1) - UNDER BLEACHER STORAGE E-006	3	800 A	55360 VA	REMOTELY OPERABLE BREAKER
4	PANEL 4DH9 - ATTIC MEZZ. A300	3	600 A	327572 VA	
5	SPARE	3	400 A	0 VA	
6	SPARE	3	225 A	0 VA	
7	SPARE	3	150 A	0 VA	
8	SPARE	3	400 A	0 VA	
9	SPARE	3	225 A	0 VA	
10	SPACE	1	--	--	
11	SPACE	1	--	--	
12	SPACE	1	--	--	
13	SPACE	1	--	--	
14	SPACE	1	--	--	
				906229 VA	
				1090 A	

Notes:

Branch Panel: 1AV3

Location: UNDER BLEACHER STORAGE E006 **Volts:** 120/208 Wye **A.I.C. Rating:** 14,000
Supply From: 1DAV2 **Phases:** 3 **Mains Type:** MLO
Mounting: SURFACE **Wires:** 4 **MCB/MLO Rating:** 150
Enclosure: TYPE 1

Notes:
PROVIDE WITH ISOLATED GROUND

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT
1	RECS - UNDER BLEACHER STORAGE E006	20 A	1	180 VA	1000 VA		1	20 A	FLOOR BOX - EVENT FLOOR D001	2
3	FLOORBOX - CROSS AISLE (AV PANEL)	20 A	1		1000 VA	1000 VA	1	20 A	RECS - AV E006A	4
5	RECS - AV E006A	20 A	1			1000 VA	1000 VA	1	20 A	RECS - AV E006A	6
7	FLOOR BOX - EVENT FLOOR D001	20 A	1	1000 VA							8
9	RECS - AV E006A	20 A	1		1000 VA						10
11											12
13											14
15											16
17											18
19											20
21											22
23											24
25											26
27											28
29											30
31	RECS - EVENT FLOOR D001 (AUDIO INTERFACE)	20 A	1	1000 VA	1000 VA		1	20 A	RECS - AV E006A	32
33	RECS - EVENT FLOOR D001 (AV PANEL)	20 A	1		1000 VA	1000 VA	1	20 A	RECS - AV E006A	34
35	RECS - AV E006A	20 A	1			1000 VA	0 VA	1	20 A	SPARE	36
37	SPARE	20 A	1	0 VA	0 VA		1	20 A	SPARE	38
39	SPARE	20 A	1		0 VA	0 VA	1	20 A	SPARE	40
41	SPARE	20 A	1			0 VA	0 VA	1	20 A	SPARE	42
43	SPARE	20 A	1	0 VA	0 VA		1	20 A	SPARE	44
45	SPARE	20 A	1		0 VA	0 VA	1	20 A	SPARE	46
47	SPARE	20 A	1			0 VA	0 VA	1	20 A	SPARE	48
49	SPARE	20 A	1	0 VA	0 VA		1	20 A	SPARE	50
51	SPARE	20 A	1		0 VA	0 VA	1	20 A	SPARE	52
53	SPARE	20 A	1			0 VA	0 VA	1	20 A	SPARE	54
		Total Load:		4180 VA	5000 VA	3000 VA				
		Total Amps:		36 A	43 A	25 A				

Notes:

Branch Panel: 1AV4

Location: UNDER BLEACHER STORAGE E006 **Volts:** 120/208 Wye **A.I.C. Rating:** 14,000
Supply From: 1DAV2 **Phases:** 3 **Mains Type:** MLO
Mounting: SURFACE **Wires:** 4 **MCB/MLO Rating:** 100
Enclosure: TYPE 1

Notes:
PROVIDE WITH ISOLATED GROUND

CKT	Circuit Description	Trip	Poles	A	B	C	Poles	Trip	Circuit Description	CKT
1	FILM ROOM A012A (PROJECTOR & SCREEN)	20 A	1	680 VA	1000 VA		1	20 A	FLOOR BOX - BALCONY (AV ENCLOSURER)	2
3	FLOORBOX - EVENT FLOOR D001	20 A	1			1000 VA	1000 VA	1	20 A	RECS - AV RACK	4
5	RECS - EVENT FLOOR D001	20 A	1				1000 VA	1000 VA	1	20 A	RECS - EVENT FLOOR D001 (AUDIO INTERFACE)	6
7	FLOORBOX - EVENT FLOOR D001	20 A	1	1000 VA	0 VA					1	20 A	SPARE	8
9	RECS - AV RACK	20 A	1			1000 VA	0 VA			1	20 A	SPARE	10
11	RECS - EVENT FLOOR D001 (AV ENCLOSURER)	20 A	1				1000 VA	0 VA		1	20 A	SPARE	12
13	SPARE	20 A	1	0 VA	0 VA					1	20 A	SPARE	14
15	SPARE	20 A	1			0 VA	0 VA			1	20 A	SPARE	16
17	SPARE	20 A	1				0 VA	0 VA		1	20 A	SPARE	18
19	SPARE	20 A	1	0 VA	0 VA					1	20 A	SPARE	20
21	SPARE	20 A	1			0 VA	0 VA			1	20 A	SPARE	22
23	SPARE	20 A	1				0 VA	0 VA		1	20 A	SPARE	24
		Total Load:		2680 VA		3000 VA		3000 VA					
		Total Amps:		22 A		25 A		25 A					

Notes:

Switchboard: 1DAV1

Location: UNDER BLEACHER STORAGE B010 **Volts:** 120/208 Wye **A.I.C. Rating:** 14,000
Supply From: T-13 **Phases:** 3 **Mains Type:** MCB
Mounting: SURFACE **Wires:** 4 **MCB/MLO Rating:** 800
Enclosure: TYPE 1

Notes:
PROVIDE WITH ISOLATED GROUND AND REMOTELY OPERABLE MAIN BREAKER.

CKT	Circuit Description	# of Poles	Trip Rating	Load	Remarks
1	PANEL 1AV1 - UNDERBLEACHER STORAGE B010	3	100 A	9000 VA	
2	PANEL 1AV2 - UNDERBLEACHER STORAGE B010	3	100 A	4360 VA	
3	EAST TVRP	3	200 A	55000 VA	
4	EAST TVRP	3	200 A	55000 VA	
5	EAST TVRP	3	400 A	110000 VA	
6	SPARE	3	100 A	0 VA	
7	SPARE	3	100 A	0 VA	
8	SPACE	1	--	--	
9					
10					
11					
12					
13					
14					
15					
16					
				233360 VA	
				648 A	

Notes:

Switchboard: 1DAV2

Location: UNDER BLEACHER STORAGE E006 **Volts:** 120/208 Wye **A.I.C. Rating:** 14,000
Supply From: T-14 **Phases:** 3 **Mains Type:** MCB
Mounting: SURFACE **Wires:** 4 **MCB/MLO Rating:** 400
Enclosure: Type 1

Notes:
PROVIDE WITH ISOLATED GROUND

CKT	Circuit Description	# of Poles	Trip Rating	Load	Remarks
1	PANEL 1AV3 - UNDER BLEACHER STORAGE E006	3	150 A	12180 VA	
2	PANEL 1AV4 - UNDER BLEACHER STORAGE E006	3	100 A	8680 VA	
3	PANEL 2AV2 - MECH. & PPD/UK AD OPS STR E102	3	125 A	34500 VA	
4	SPARE	3	100 A	0 VA	
5	SPARE	3	150 A	0 VA	
6	SPACE	1	--	--	
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
				55360 VA	
				154 A	

Notes:

Switchboard: 1DH1

Location: UNDER BLEACHER STORAGE E006 **Volts:** 480/277 Wye **A.I.C. Rating:** 22,000
Supply From: SWBD2 **Phases:** 3 **Mains Type:** MLO
Mounting: SURFACE **Wires:** 4 **MCB/MLO Rating:** 800
Enclosure: TYPE 1

Notes:

CKT	Circuit Description	# of Poles	Trip Rating	Load	Remarks
1	TRANSFORMER T-8 (SUPPLIES 1DL14) - UNDER BLEACHER STORAGE E-006	3	500 A	339539 VA	
2	PANEL 1PH21 - MECHANICAL E-003	3	225 A	23940 VA	
3	TRANSFORMER T-10 (SUPPLIES 1PL24 & 1PL25) - MECH & ELEC E008	3	125 A	9905 VA	
4	PANEL 1PH18 - UNDER BLEACHER STORAGE E-006	3	100 A	0 VA	
5	SPARE	3	225 A	0 VA	
6	SPARE	3	150 A	0 VA	
7	SPARE	3	225 A	0 VA	
8	SPACE	1	--	--	
9					
10					
11					
12					
13					
14					
15					
16					
				373343 VA	
				449 A	

Notes:

Switchboard: 1DL1

Location: TRANSFORMER B015D **Volts:** 120/208 Wye **A.I.C. Rating:** 22,000
Supply From: T-5 **Phases:** 3 **Mains Type:** MCB
Mounting: SURFACE **Wires:** 4 **MCB/MLO Rating:** 1600
Enclosure: TYPE 1

Notes: MAIN BREAKER SHALL BE REMOTELY OPERABLE.

CKT	Circuit Description	# of Poles	Trip Rating	Load	Remarks
1	EXISTING PANEL DCP - ELECTRICAL C022A	3	400 A	100000 VA	
2	PANEL 1DL2 - ELECTRICAL C022A	3	600 A	89101 VA	
3	PANEL 1PL1 - ELECTRICAL B015A	3	150 A	24765 VA	
4	SPARE	3	150 A	0 VA	
5	PANEL 1PL9 - UNDER BLEACHER STORAGE B010	3	150 A	18976 VA	
6	PANEL 1PL10 - UNDER BLEACHER STORAGE B010	3	150 A	19980 VA	
7	PANEL 2PL4 - CLUB STORAGE B102	3	150 A	34648 VA	
8	PANEL 2PL5 - STORAGE B104A	3	150 A	24564 VA	
9	PANEL 2PL6 - CONCESSION B105	3	400 A	88259 VA	
10	PANEL 2PL7 - CUST. STORAGE B-202	3	150 A	10819 VA	
11	PANEL 2PL9 - TABLE STORAGE D100D	3	200 A	24695 VA	
12	IDF B010A - PDU	3	60 A	14400 VA	
13	SPARE	3	150 A	0 VA	
14	SPARE	3	150 A	0 VA	
15	SPARE	3	150 A	0 VA	
16	SPACE	1	--	--	
				450133 VA	
				1249 A	

Notes:

Switchboard: 1DL2

Location: ELECTRICAL C022A **Volts:** 120/208 Wye **A.I.C. Rating:** 22,000
Supply From: 1DL1 **Phases:** 3 **Mains Type:** MLO
Mounting: SURFACE **Wires:** 4 **MCB/MLO Rating:** 600
Enclosure: TYPE 1

Notes:

CKT	Circuit Description	# of Poles	Trip Rating	Load	Remarks
1	PANEL 1PL3 - ELECTRICAL C022A	3	150 A	31720 VA	
2	PANEL 1PL4 - ELECTRICAL C022A	3	150 A	22592 VA	
3	PANEL 2PL1 - CORRIDOR C140	3	150 A	34838 VA	
4	SPARE	3	150 A	0 VA	
5	SPARE	3	150 A	0 VA	
6	SPARE	3	150 A	0 VA	
7	SPACE	1	--	--	
8	SPACE	1	--	--	
9					
10					
11					
12					
13					
14					
15					
16					
				89101 VA	
				247 A	

Notes:

Switchboard: 1DL14

Location: UNDER BLEACHER STORAGE E006 **Volts:** 120/208 Wye **A.I.C. Rating:** 14,000
Supply From: T-8 **Phases:** 3 **Mains Type:** MCB
Mounting: SURFACE **Wires:** 4 **MCB/MLO Rating:** 1000
Enclosure: TYPE 1

Notes: PROVIDE WITH REMOTELY OPERABLE MAIN BREAKER.

CKT	Circuit Description	# of Poles	Trip Rating	Load	Remarks
1	PANEL 1PL15 - UNDER BLEACHER STORAGE E006	3	150 A	30045 VA	
2	PANEL 1PL17 - UNDER BLEACHER STORAGE E006	3	150 A	27275 VA	
3	PANEL 1PL19 - CORRIDOR E000D	3	150 A	10220 VA	
4	PANEL 1PL20 - CORRIDOR E000D	3	150 A	11345 VA	
5	PANEL 2PL10 - CONCESSION STORAGE D100A	3	150 A	15141 VA	
6	PANEL 2PL12 - MECHANICAL & PPD/UK AD OPS STORAGE E102	3	200 A	20824 VA	
7	PANEL 2PL13 - STORAGE E106	3	200 A	24929 VA	
8	PANEL 2PL14 - CONCESSION E105	3	400 A	110787 VA	
9	PANEL 2PL15 - CUSTODIAL STORAGE E-226	3	150 A	14655 VA	
10	EXISTING PANEL C	3	200 A	30000 VA	
11	PANEL 1PL27 - MECHANICAL E003A	3	200 A	30000 VA	
12	IDF E006B - PDU	3	60 A	14400 VA	
13	SPARE	1	200 A	0 VA	
14	SPARE	1	150 A	0 VA	
15	SPARE	1	200 A	0 VA	
16	SPACE	1	--	--	
				339539 VA	
				942 A	

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NOT FOR CONSTRUCTION

ELECTRICAL PANEL SCHEDULES

IMPROVE MEMORIAL COLISEUM
FOR:
THE UNIVERSITY OF KENTUCKY
LEXINGTON, KENTUCKY

Architect of Record:
Civil Engineer:
Landscape Architect:
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p 859.254.4018

Signature Sports Architect:
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UK# 2520.0

Project No: 1924
Drawn By: ND
Rev'd By: WT

ISSUED FOR:

REVISIONS

#	DATE	DESCRIPTION

CONSTRUCTION DOCUMENTS

E600

ELECTRICAL PANEL SCHEDULES

DATE ISSUED:
JANUARY 23, 2023

Specification Index

Item No.	Item Rev.	Package No.	Package Rev.	Description	Reference No.
				Medium Voltage Switchgear Warranty	Closeout
				Medium Voltage Switchgear O&M	Closeout

SECTION 261300 - MEDIUM-VOLTAGE SWITCHGEAR

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 metal-enclosed interrupter switchgear with the following optional components, features, and accessories:

1. Copper, tin-plated main bus.
2. Surge arresters.
3. Provisions for future devices.
4. Mimic bus.

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

1.4 SUBMITTALS

A. Product Data: For each type of switchgear and related equipment, include the following:

1. Rated capacities, operating characteristics, furnished specialties, and accessories for individual interrupter switches.

B. Shop Drawings: For each type of switchgear and related equipment, include the following:

1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show method of field assembly and location and size of each field connection. Include the following:

a. Tabulation of installed devices with features and ratings.

b. Outline and general arrangement drawing showing dimensions, shipping sections, and weights of each assembled section.

c. Drawing of cable termination compartments showing preferred locations for conduits and indicating space available for cable terminations.

d. Floor plan drawing showing locations for anchor bolts.

e. Current ratings of buses.

f. Short-time and short-circuit ratings of switchgear assembly.

g. Nameplate legends.

h. Mimic-bus diagram.

C. Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around switchgear where piping and ducts are prohibited. Show switchgear layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Identify field measurements.

D. For switchgear and switchgear components 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. Manufacturer's written instructions for testing and adjusting switch devices.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of switchgear and associated components through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of switchgear and are based on the specific system indicated.

C. 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.

D. Comply with IEEE C2.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver in sections of lengths that can be moved past obstructions in delivery path as indicated.

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

C. If stored in areas subjected to weather, cover switchgear to provide protection from weather, dirt, dust, corrosive substances, and physical damage.

1.7 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. Touchup Paint: Three containers of paint matching enclosure finish, each 0.5 pint (250 mL).

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Description: Factory assembled and tested and complying with IEEE C37.20.1.

B. Ratings: Suitable for application in 3-phase, 60-Hz, solidly grounded-neutral system.

C. System Voltage: 12.47 kV nominal; 15 kV maximum.

2.2 PADMOUNT SWITCH

A. Manufacturer

1. S & C Electric Vista, 5-way switch with a tie-switch

B. General

1. The switchgear shall be in accordance with the one-line diagram and shall conform to the following specification.

2. The switchgear shall consist of a gas-tight tank containing SF_6 gas and load-interrupter switches with visible open gaps and integral visible grounds. Load-interrupter switch terminals shall be equipped with bushings rated 600 amperes continuous to provide for elbow connection. Manual operating mechanisms and viewing windows shall be located on the opposite side of the tank from the bushings and bushing wells so that operating personnel shall not be required to perform any routine operations in close proximity to high voltage elbows and cables. Meeting bays shall be connected to switching cubicles via bushings connecting the bus of the switching cubicles to the bus of the metering bay. Low profile enclosure.

3. Ratings

a. The ratings for the integrated switchgear shall be as designated below.

1) Frequency, Hz: 60

2) Short-Circuit Rating Amperes, RMS Symmetrical: 12,500

3) kV, Maximum: 15.5

4) kV, BIL: 95

5) Main Bus Continuous, Amperes: 600

6) Three-Pole Load-Interrupter Switches Continuous, Amperes: 600

7) Load Dropping, Amperes: 600

8) Fault-Closing, Duty-Cycle

a) Three-Time, Amperes RMS Symmetrical : 12,500

b) Three-Time, Amperes, Peak : 32,000

c) 10-Time, Amperes RMS Symmetrical: 12,500

d) 10-Time, Amperes, Peak : 32,000

4. Compliance with Standards and Codes

a. The switchgear shall conform to or exceed the applicable requirements of the following standards and codes:

1) Comply with ANSI C57.12.28, where applicable.

2) Comply with The applicable portions of ANSI C37.71, ANSI C37.72, ANSI C37.73, IEC 56, and IEC 265-1 (Class A), where applicable.

C. Construction

1. SF_6-Gas Insulation

   a. The SF6 gas shall conform to ASTM D2472.

   b. The switchgear shall be filled with SF_6 gas to a pressure of 7 psig at 68º F.

   c. The switchgear shall withstand system voltage at a gas pressure of 0 psig at 68º F.

   d. A gas-fill valve shall be provided.

   e. A temperature-compensated pressure gauge shall be provided that is color coded to show the operating range. The gauge shall be mounted inside the gas-tight tank (visible through a large viewing window) to provide consistent pressure readings regardless of the temperature or altitude at the installation site.

2. Gas-Tight Tank

   a. The tank shall be submersible and able to withstand up to 10 feet of water over the base.

   b. The tank shall be of welded construction and shall be made of 7-gauge mild steel or Type 304 L stainless steel, as specified in Section IV.

3. Viewing Windows

   a. Each load-interrupter switch shall be provided with a large viewing window at least 6 inches by 12 inches to allow visual verification of the switch-blade position (open, closed, and grounded) while shining a flashlight on the blades.

   b. A cover shall be provided for each viewing window to prevent operating personnel from viewing the flash which may occur during switching operations.

   c. High-Voltage Bus

      1) Bus and interconnections shall withstand the stresses associated with short-circuit currents up through the maximum rating of the switchgear.

   d. Provisions for Grounding

      1) One ground-connection pad shall be provided on the gas-tight tank of the switchgear.

      2) The ground-connection pad shall be constructed of stainless steel and welded to the gastight tank, and shall have a short-circuit rating equal to that of the switchgear.

   e. Terminations

      1) Terminals for load-interrupter switches shall have 600- ampere bushings.

      2) Bushings and bushing wells shall be located on one side of the gear to reduce the required operating clearance.

D. Basic Components

1. Load-Interrupter Switches

   a. The three-phase, gang-operated load-interrupter switches shall have a three-time and ten-time duty-cycle fault-closing rating as specified under “Ratings.” This rating defines the

ability to close the switch the designated number of times against a three-phase fault with asymmetrical (peak) current in at least one phase equal to the rated value, with the switch remaining operable and able to carry and interrupt rated current. Certified test abstracts establishing such ratings shall be furnished upon request.

b. The switch shall be provided with an integral ground position that is readily visible through the viewing window to eliminate the need for cable handling and exposure to high voltage to ground the equipment.

c. The ground position shall have a three-time and ten-time duty-cycle fault-closing rating.

d. The switch shall be provided with an open position that is readily visible through the viewing window to eliminate the need for cable handling and exposure to high voltage to establish a visible gap.

e. The open gaps of the switch shall be sized to allow cable testing through a feed thru bushing or the back of the elbow.

2. Operating Mechanisms

a. Load-interrupter switches and fault interrupters shall be operated by means of a quick-make, quick-break mechanism.

b. The manual handle shall charge the operating mechanism for opening, closing, and grounding of the switches and fault interrupters.

c. A single, integrated operating mechanism shall fully operate each fault interrupter or load interrupter switch in a continuous movement, so that additional operations are not required to establish open or ground positions.

d. Operating mechanisms shall be equipped with an operation selector to prevent inadvertent operation from the closed position directly to the grounded position, or from the grounded position directly to the closed position. The operation selector shall require physical movement to the proper position to permit the next operation.

e. Operating shafts shall be pad-lockable in any position to prevent operation.

f. The operation selector shall be pad-lockable to prevent operation to the grounded position.

g. The operating mechanism shall indicate switch position which shall be clearly visible from the normal operating position.

E. Switchgear Style

1. Pad-mounted Style

a. The gas-tight tank shall be made of 7-gauge mild-steel.

b. The switch shall be suitable for mounting on grade mounted slab.

F. Labeling

1. Hazard-Alerting Signs

a. Each unit of switchgear shall be provided with a “Danger—Keep Away—Hazardous Voltage—Will Shock, Burn, or Cause Death” sign.

2. Nameplates, Ratings Labels, and Connection Diagrams

a. Each unit of switchgear shall be provided with a ratings label indicating the following: voltage rating; main bus continuous rating; short-circuit rating; fault-interrupter ratings including interrupting and duty-cycle fault-closing; and load-interrupter switch ratings including duty-cycle fault-closing and short-time.

2.3 Components

A. Main Bus: copper; full length of switchgear.

B. Ground Bus.

C. Surge Arresters: Distribution class, elbow type

1. Install in cable termination compartments on elbows in each phase of circuit.

2. Coordinate rating with circuit voltage.

2.4 Identification

A. Materials: Identify units, devices, controls, and wiring.

2.5 Source Quality Control

A. Before shipment of equipment, perform the following tests and prepare test reports:

1. Production tests on completed switchgear assembly according to IEEE C37.20.2.

B. Prepare equipment for shipment.

1. Provide suitable crating, blocking, and supports so equipment will withstand expected domestic shipping and handling shocks and vibration.

2. Weatherproof equipment for shipment. Close connection openings to prevent entrance of foreign material during shipment and storage.

PART 3 - EXECUTION

3.1 Field Quality Control

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each switchgear bus, component, connecting supply and feeder.

2. Test continuity of each circuit.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:

1. Inspect switchgear, wiring, components, connections, and equipment installation.

2. Assist in field testing of equipment.

3. Report results in writing.

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

3.2 Demonstration

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

END OF SECTION 261300

Specification Index

Drawing Index

Item No.	Item Rev.	Package No.	Package Rev.	Description	Reference No.
				Generator Warranty	Closeout
				Generator O&M	Closeout

SECTION 263213.13 - DIESEL EMERGENCY ENGINE GENERATORS

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 suppling the packaged diesel engine generator, including delivery to the site, startup testing and warranty for emergency use with the following features:

1. Diesel engine.
2. Diesel fuel-oil system.
3. Control and monitoring.
4. Generator overcurrent and fault protection.
5. Generator, exciter, and voltage regulator.
6. Outdoor engine generator enclosure.
7. Vibration isolation devices.
8. Finishes.

B. Related Requirements:
1. Section 263600 "Transfer Switches" for transfer switches, including sensors and relays to initiate automatic-starting and -stopping signals for engine generators.

1.3 DEFINITIONS

A. EPS: Emergency power supply.

B. EPSS: Emergency power supply system.

C. Operational Bandwidth: The total variation, from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.4 SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Include thermal damage curve for generator.
3. Include time-current characteristic curves for generator protective device.
4. Include fuel consumption in gallons per hour (liters per hour) at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
5. Include generator efficiency at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
6. Include airflow requirements for cooling and combustion air in cubic feet per minute (cubic meters per minute) at 0.8 power factor, with air-supply temperature of 95, 80, 70, and 50 deg F (35, 27,

21, and 10 deg C). Provide Drawings indicating requirements and limitations for location of air intake and exhausts.

7. Include generator characteristics, including, but not limited to, kilowatt rating, efficiency, reactances, and short-circuit current capability.

B. Shop Drawings:

1. Include plans and elevations for engine generator and other components specified. Indicate access requirements affected by height of subbase fuel tank.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Identify fluid drain ports and clearance requirements for proper fluid drain.
4. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and supported equipment. Include base weights.
6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for EPS equipment and functional relationship between all electrical components.

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: One for every 10 of each type and rating, but no fewer than one of each.
2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by the manufacturer.

B. Maintenance Proximity: Not more than four hours' travel time from the Installer's place of business to the Project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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. Caterpillar, Inc.; Electric Power Division.
2. Cummins Power Generation.
3. Generac Power Systems, Inc.
4. Kohler Power Systems.

B. Source Limitations: Obtain packaged engine generators and auxiliary components from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. B11 Compliance: Comply with B11.19.

B. NFPA Compliance:

1. Comply with NFPA 37.
2. Comply with NFPA 70.
3. Comply with NFPA 99.
4. Comply with NFPA 110 requirements for Level 2 EPSS.

C. UL Compliance: Comply with UL 2200.

D. Unit must be EPA Certified.

E. Engine Exhaust Emissions: Comply with EPA Tier 4 requirements and applicable state and local government requirements.

F. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by engine generator, including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

G. Environmental Conditions: Engine generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 5 to 104 deg F (Minus 15 to plus 40 deg C).
2. Relative Humidity: Zero to 95 percent.
3. Altitude: Sea level to 1000 feet (300 m).

2.3 ENGINE GENERATOR ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

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. EPSS Class: Engine generator shall be classified as a Class 2 according to NFPA 110.

D. Power Factor: 0.8, lagging.

E. Frequency: 60 Hz

F. Voltage: 480 V ac.

G. Phase: Three-phase, four-wire wye.

H. Governor: Adjustable isochronous, with speed sensing.

I. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and engine generator center of gravity.

J. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries, with capacity as required to operate as a unit as evidenced by records of prototype testing.
2. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

K. Engine Generator Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage, from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency, from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: Comply with NFPA 110, Type 10 system requirements.

2.4 DIESEL ENGINE

A. Fuel: ASTM D 975 diesel fuel oil, Grade 2-D S15.

B. Rated Engine Speed: 1800 rpm.

C. Lubrication System: Engine or skid mounted.

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

D. Jacket Coolant Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity and with UL 499.

E. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.

2. Size of Radiator: Adequate to contain expansion of total system coolant, from cold start to 110 percent load condition.
3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant-system pressure for engine used. Equip with gage glass and petcock.
4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, UV-, and abrasion-resistant fabric.

    a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
    b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

F. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

1. Minimum sound attenuation of 25 dB at 500 Hz.
2. Sound level measured at a distance of 25 feet (8 m) from exhaust discharge after installation is complete shall be 78 dBA or less.

G. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

H. Starting System: 12 V electric, with negative ground.

1. Components: Sized so they are not damaged during a full engine-cranking cycle, with ambient temperature at maximum specified in "Performance Requirements" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified.
4. Battery: Adequate capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least three times without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 50 deg F (10 deg C) regardless of external ambient temperature within range specified in "Performance Requirements" Article. Include accessories required to support and fasten batteries in place. Provide ventilation to exhaust battery gases.
7. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
8. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
9. Battery Charger: Current-limiting, automatic-equalizing, and float-charging type. Unit shall comply with UL 1236 and include the following features:

    a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
    b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg F (minus 40 deg C) to 140 deg F (plus 60 deg C) to prevent overcharging at high temperatures and undercharging at low temperatures.

c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
f. Enclosure and Mounting: NEMA 250, Type 1 wall-mounted cabinet.

2.5 DIESEL FUEL-OIL SYSTEM

A. Comply with NFPA 30.

B. Piping: Fuel-oil piping shall be Schedule 40 black steel, complying with requirements in Section 231113 "Facility Fuel-Oil Piping." Cast iron, aluminum, copper, and galvanized steel shall not be used in the fuel-oil system.

C. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions.

D. Fuel Filtering: Remove water and contaminants larger than 1 micron.

E. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

F. Subbase-Mounted, Double-Wall, Fuel-Oil Tank: Factory installed and piped, complying with UL 142 fuel-oil tank. Features include the following:

1. Tank level indicator.
2. Fuel-Tank Capacity: Fuel for 24 hours' continuous operation at 100 percent rated power output.
3. Leak detection in interstitial space.
4. Vandal-resistant fill cap.
5. Containment Provisions: Comply with requirements of authorities having jurisdiction.

2.6 FUEL OIL STORAGE

A. Comply with NFPA 30.

B. Double-Walled, Free-Standing Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:

1. Tank level indicator.
2. Capacity: Fuel for twenty-four hours' continuous operation at 100 percent rated power output.
3. Vandal-resistant fill cap.
4. Containment Provisions: Comply with requirements of authorities having jurisdiction.
5. Provide with additional floats and monitoring as required for remote fill system per detail on drawings.
6. Discharge line shall exit from top of tank. Tanks with bottom discharge lines shall be provided with a fusible link operated safety-shut-off-valve at the tank outlet.
7. Fuel distribution system shall automatically shut down the flow of fuel in the event of a fire or detector leak. Install and arrange safety-shut-off-valves to isolate fuel tank. Use of a fusible link operated valve is an acceptable way to shut-off discharge line(s).
8. Provide and install a manual remote-shut off for the fuel pump and safety-shut-off-valves at the location of the main fire alarm panel.
9. Tank vent line shall be extended to building exterior.

2.7 CONTROL AND MONITORING

A. Automatic-Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of engine generator. When mode-selector switch is switched to the on position, engine generator starts. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the control panel from engine generator vibration. Panel shall be powered from the engine generator battery.

C. Control and Monitoring Panel:

1. Digital controller with integrated LCD display, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
2. Analog control panel with dedicated gages and indicator lights for the instruments and alarms indicated below.
3. Instruments: Located on the control and monitoring panel and viewable during operation.

    a. Engine lubricating-oil pressure gage.
    b. Engine-coolant temperature gage.
    c. DC voltmeter (alternator battery charging).
    d. Running-time meter.
    e. AC voltmeter, for each phase.
    f. AC ammeter, for each phase.
    g. AC frequency meter.
    h. Generator-voltage-adjusting rheostat.

4. Controls and Protective Devices: Controls, shutdown devices, and common visual alarm indication as required by NFPA 110 for Level 2 system, including the following:

    a. Cranking control equipment.
    b. Run-Off-Auto switch.
    c. Control switch not in automatic position alarm.
    d. Overcrank alarm.
    e. Overcrank shutdown device.
    f. Low water temperature alarm.
    g. High engine temperature pre-alarm.
    h. High engine temperature.
    i. High engine temperature shutdown device.
    j. Overspeed alarm.
    k. Overspeed shutdown device.
    l. Low-fuel main tank.

        1) Low-fuel-level alarm shall be initiated when the level falls below that required for operation for the duration required for the indicated EPSS class.

    m. Coolant low-level alarm.
    n. Coolant low-level shutdown device.
    o. Coolant high-temperature prealarm.
    p. Coolant high-temperature alarm.
    q. Coolant low-temperature alarm.

r. Coolant high-temperature shutdown device.
s. EPS load indicator.
t. Battery high-voltage alarm.
u. Low-cranking voltage alarm.
v. Battery-charger malfunction alarm.
w. Battery low-voltage alarm.
x. Lamp test.
y. Contacts for local and remote common alarm.
z. Low-starting air pressure alarm.
aa. Low-starting hydraulic pressure alarm.
bb. Remote manual-stop shutdown device.
cc. Air shutdown damper alarm when used.
dd. Air shutdown damper shutdown device when used.
ee. Generator overcurrent-protective-device not-closed alarm.

D. Connection to Datalink:

1. A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication.
2. Provide connections for datalink transmission of indications to remote data terminals via BACNet. The monitoring system must be 100% compatible and interface with the Building Management System. See Division 23 specifications for additional information. All necessary hardware and wiring shall be provided by the Contractor of this division to achieve complete transfer of all monitoring information required by the BMS.

E. Remote Alarm Annunciator: Comply with NFPA 99. An LED indicator light labeled with proper alarm conditions shall identify each alarm event, and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

1. Overcrank alarm.
2. Coolant low-temperature alarm.
3. High engine temperature prealarm.
4. High engine temperature alarm.
5. Low lube oil pressure alarm.
6. Overspeed alarm.
7. Low-fuel main tank alarm.
8. Low coolant level alarm.
9. Low-cranking voltage alarm.
10. Contacts for local and remote common alarm.
11. Audible-alarm silencing switch.
12. Air shutdown damper when used.
13. Run-Off-Auto switch.
14. Control switch not in automatic position alarm.
15. Fuel tank derangement alarm.
16. Fuel tank high-level shutdown of fuel-supply alarm.
17. Lamp test.
18. Low-cranking voltage alarm.
19. Generator overcurrent protective device not closed.

F. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator unless otherwise indicated.

2.8 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with UL 489.

1. Tripping Characteristic: Designed specifically for generator protection.
2. Trip Rating: Matched to generator output rating.
3. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
4. Mounting: Adjacent to or integrated with control and monitoring panel.

B. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground fault.

1. Indicate ground fault with other engine generator alarm indications.
2. Trip generator protective device on ground fault.

2.9 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H or Class F.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Enclosure: Dripproof.

G. Instrument Transformers: Mounted within generator enclosure.

H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified and as required by NFPA 110.

1. Adjusting Rheostat on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.

I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Subtransient Reactance: 12 percent, maximum.

2.10 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

1. Material: Standard neoprene separated by steel shims.
2. Shore A Scale Durometer Rating: 50.
3. Number of Layers: Three.

B. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

1. Housing: Steel with resilient, vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment-mounting and -leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of 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.

2.11 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.12 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine generator using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

B. Project-Specific Equipment Tests: Before shipment, factory test engine generator and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
2. Test generator, exciter, and voltage regulator as a unit.
3. EPA certification test.
4. Full-load run.
5. Maximum power.
6. Voltage regulation.
7. Transient and steady-state governing.
8. Single-step load pickup.
9. Safety shutdown.
10. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
11. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.

B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.

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

3.2 APPROVALS

A. Generator installer is responsible to obtain all approvals required from the Fire Marshall and Authority Having Jurisdiction.

3.3 CONNECTIONS

A. Manufacturer is to size the generator exhaust pipe. The HVAC plans for length of pipe, elevation change of pipe, and number of turns will be supplied after the bid on the equipment.

B. The generator exhaust piping, critical silencer including 4" of insulation must fit within the generator room with clear height of 10-3".

3.4 FIELD QUALITY CONTROL

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

B. Perform tests and inspections with the assistance of a factory-authorized service representative.

C. Tests and Inspections:

1. Perform tests recommended by manufacturer and in "Visual and Mechanical Inspection" and "Electrical and Mechanical Tests" subparagraphs below, as specified in the NETA ATS. Certify compliance with test parameters.

    a. Visual and Mechanical Inspection:

        1) Compare equipment nameplate data with Drawings and the Specifications.
        2) Inspect physical and mechanical condition.
        3) Inspect anchorage, alignment, and grounding.
        4) Verify that the unit is clean.

    b. Electrical and Mechanical Tests:

        1) Perform insulation-resistance tests according to IEEE 43.

            a) Machines Larger Than 200 hp (150 kW): Test duration shall be 10 minutes. Calculate polarization index.

b) Machines 200 hp (150 kW) or Less: Test duration shall be one minute. Calculate the dielectric-absorption ratio.

2) Test protective relay devices.
3) Verify phase rotation, phasing, and synchronized operation as required by the application.
4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
5) Perform vibration test for each main bearing cap.
6) Conduct performance test according to NFPA 110.
7) Verify correct functioning of the governor and regulator.

2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here, including, but not limited to, single-step full-load pickup test.
3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
c. Verify acceptance of charge for each element of the battery after discharge.
d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
6. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg (120 kPa). Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
7. Exhaust Emissions Test: Comply with applicable government test criteria.
8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.

D. Coordinate tests with tests for transfer switches and run them concurrently.

E. Test instruments shall have been calibrated within the past 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.

F. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

G. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

H. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

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

J. Retest: Correct deficiencies identified by tests and observations, and retest until specified requirements are met.

K. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component, indicating satisfactory completion of tests.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION 263213.13

SECTION 263600 - TRANSFER SWITCHES

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 suppling the two transfer switches rated 600 V and less indicated on the drawings, including delivery to the site, factory startup and testing, including the following:

1. Automatic transfer switches.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.

B. Source Limitations: Obtain automatic transfer switches through one source from a single manufacturer.

C. 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.

D. Comply with NEMA ICS 1.

E. Comply with NFPA 70.

F. Comply with NFPA 99.

G. Comply with NFPA 110.

H. Comply with UL 1008 unless requirements of these Specifications are stricter.

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:

1. Contactor Transfer Switches:

a. Caterpillar; Engine Div.
b. Emerson; ASCO Power Technologies, LP.
c. Generac Power Systems, Inc.
d. GE Zenith Controls.
e. Kohler Power Systems; Generator Division.

f. Onan/Cummins Power Generation; Industrial Business Group.
g. Russelectric, Inc.
h. Spectrum Detroit Diesel.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

G. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

H. Battery Charger: For generator starting batteries.

1. Float type rated 10 A.
2. Ammeter to display charging current.
3. Fused ac inputs and dc outputs.

I. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.

J. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Division 26 Section "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

K. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

D. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

E. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel. The transfer switch must also be able to communicate its status to the Facility Management System. Provide any additional equipment necessary to accomplish this communication functionality. Coordinate with the temperature controls contractor.

F. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.

G. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. LED Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.

10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

2.4 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 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.

3.2 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Division 01 Section "Demonstration and Training."

B. Coordinate this training with that for generator equipment.

END OF SECTION 263600

ROOM NUMBER	ROOM NAME
A000C	CORRIDOR
A000D	CORRIDOR
A009	IT STORAGE
A010	COACHES LOUNGE
A010A	SHOWER
A010B	SHOWER
A011	CUST.
A012	WOMEN'S CORRIDOR
A012A	FILM ROOM
A012B	WOMEN'S LOUNGE
A012C	WOMEN'S LOCKER ROOM
A012D	WOMEN'S TOILET
A012E	SHOWERS
A013	OFFICIALS LOCKER ROOM
A013A	WOMEN'S TOILET
A013B	MEN'S TOILET
A014B	TOILET
A014C	FITNESS ROOM
A017	GYMNASTICS LOCKER ROOM
A017A	GYMNASTICS SHOWERS/ RESTROOM
A017B	GYMNASTICS TEAM LOUNGE
A017C	GYMNASTICS EQUIPMENT ROOM
A017D	VESTIBULE
A019	VOLLEYBALL TEAM LOCKER ROOM
A019A	VESTIBULE
A019B	VOLLEYBALL TEAM LOUNGE
A019C	VOLLEYBALL SHOWERS/ RESTROOM
A021	NUTRITION STORAGE
A023	IDF
A025	VOLLEYBALL EQUIPMENT STORAGE
B000A	CORRIDOR
B000C	CORRIDOR
B000D	RAMP
B001	MECHANICAL
B003B	UNASSIGNED SHELL SPACE
B005	STUNT TEAM LOUNGE
B005A	STUNT TEAM RESTROOM
B005A	STAFF LOCKER ROOM
B005B	STAFF LOCKER ROOM
B005B	STORAGE
B005C	STUNT TEAM LOCKER ROOM
B007A	STAFF LOCKER ROOM
B009	MEDIA HOSPITALITY ROOM
B009A	MEDIA CORRIDOR
B009B	MEDIA PHOTOGRAPHY ROOM
B009C	MEDIA
B009C-1	IDF
B009D	MEDIA CORRIDOR
B009E	VESTIBULE
B009F	MEN'S RESTROOM
B009G	WOMEN'S RESTROOM
B009H	MEDIA STORAGE
B010	UNDER BLEACHER STORAGE
B010A	IDF
B010A	IDF
B010B	AV
B011	DANCE LOCKER/CUBBIES
B011A	DANCE TEAM RESTROOM
B011B	DANCE TEAM
B013	CUSTODIAL
B015	UK AD OPS WORK ROOM
B015	UK AD OPS WORK ROOM
B015A	ELECTRICAL
B015C	UK AD OPS RECEIVING
B015D	TRANSFORMER
B015D	GENERATOR
B016	MECHANICAL
B055	CORRIDOR
B055	CORRIDOR
B109A	IDF
C000	LOBBY
C000A	VESTIBULE
C000B	RECEPTION
C00C	CORRIDOR
C000D	CORRIDOR
C000E	CORRIDOR
C001	OFFICE
C002	STUDY
C003	OFFICE
C004	STUDY
C005	OFFICE
C006	STUDY
C007	CONFERENCE ROOM
C008	OFFICE
C009	COUNSELORS OFFICE
C010	OFFICE
C011	COUNSELORS OFFICE
C012	OFFICE
C013	COUNSELORS OFFICE
C014	GROUP ROOM
C014A	STORAGE
C015	COUNSELORS OFFICE
C016	STUDY ROOM
C017	BREAK ROOM
C018	STUDY ROOM
C020	LOUNGE/ CHECK IN
C020A	RECEPTION
C020B	COPY
C022	CORRIDOR
C022A	ELECTRICAL
C022B	MEN'S RESTROOM
C022C	CUSTODIAL
C024	CORRIDOR
C024A	WOMEN'S RESTROOM
C026	COMPUTER LAB
C026A	STORAGE
C027	INTERN OFFICE
C028	COUNSELORS OFFICE
C029	INTERN OFFICE
C030	GRAD ASSIST OFFICE
C031	INTERN OFFICE
C032	COUNSELORS OFFICE
C033	INTERN OFFICE
C034	COUNSELORS OFFICE
C035	INTERN OFFICE
C036	IDF
C040	QUIT STUDY
C042	GROUP LEARNING
C042A	CORRIDOR
C044	DIRECTOR'S OFFICE
C046	ASSISTANT AD OFFICE
C048	STORAGE
C130	ELEVATOR CONTROL ROOM
D000	LOBBY
D001	EVENT FLOOR
D001B	STORAGE
D001C	STORAGE
D002	COURT LOBBY
D002A	ELEVATOR LOBBY
D002B	CORRIDOR
D002C	TOILET
D002D	TOILET
D002E	TOILET
D002F	MACHINE ROOM
D002G	STORAGE
D003	COURT LOBBY
D003A	ELEVATOR LOBBY
D003B	CORRIDOR
D003C	TOILET
D003D	TOILET
D003E	TOILET
D003F	STORAGE
D003G	MACHINE ROOM
D010A	WEST EVENT BOWL
D010B	EAST EVENT BOWL
E000A	CORRIDOR
E000B	RAMP
E000C	CORRIDOR
E000E	CORRIDOR
E000F	RAMP
E001	EVENT/UK AD OPS STORAGE
E003	MECHANICAL
E003A	MECHANICAL
E003B	IDF
E005	VISITING TEAM COACH MTG. ROOM
E006	UNDER BLEACHER STORAGE
E006A	AV
E006B	IDF
E007	MBBALL COACH LOCKER ROOM LOUNGE
E007A	MBBALL COACH LOCKER ROOM
E007B	MBBALL COACH RESTROOM
E007D	MBBALL COACH SHOWER ROOM
E008	MECHANICAL/ ELECTRICAL
E011	CUSTODIAL
E015	CREATIVE CONTENT STORAGE
E018	STORAGE
E026	WORK ROOM
E027	AD OPS OFFICE
E028	WOMEN'S RESTROOM
E029	AD OPS OFFICE
E030	AD FILE & ARCHIVE STORAGE
E031	AD OPS OFFICE
E032	MEN'S RESTROOM
E033	AD OPS OFFICE
E034	CHEER/DANCE STORAGE
E035	AD OPS OFFICE
E037	CHEER/DANCE OFFICE
E038	WOMEN'S BASKETBALL STORAGE
E038A	WOMEN'S BASKETBALL STORAGE
E039	CHEER/DANCE OFFICE
E041	CHEER/DANCE OFFICE
E042	VOLLEYBALL STORAGE
E044	MEN'S BASKETBALL STORAGE
E044A	OFFICE
E044B	MECHANICAL
E045	VISITING TEAM LOCKER ROOM

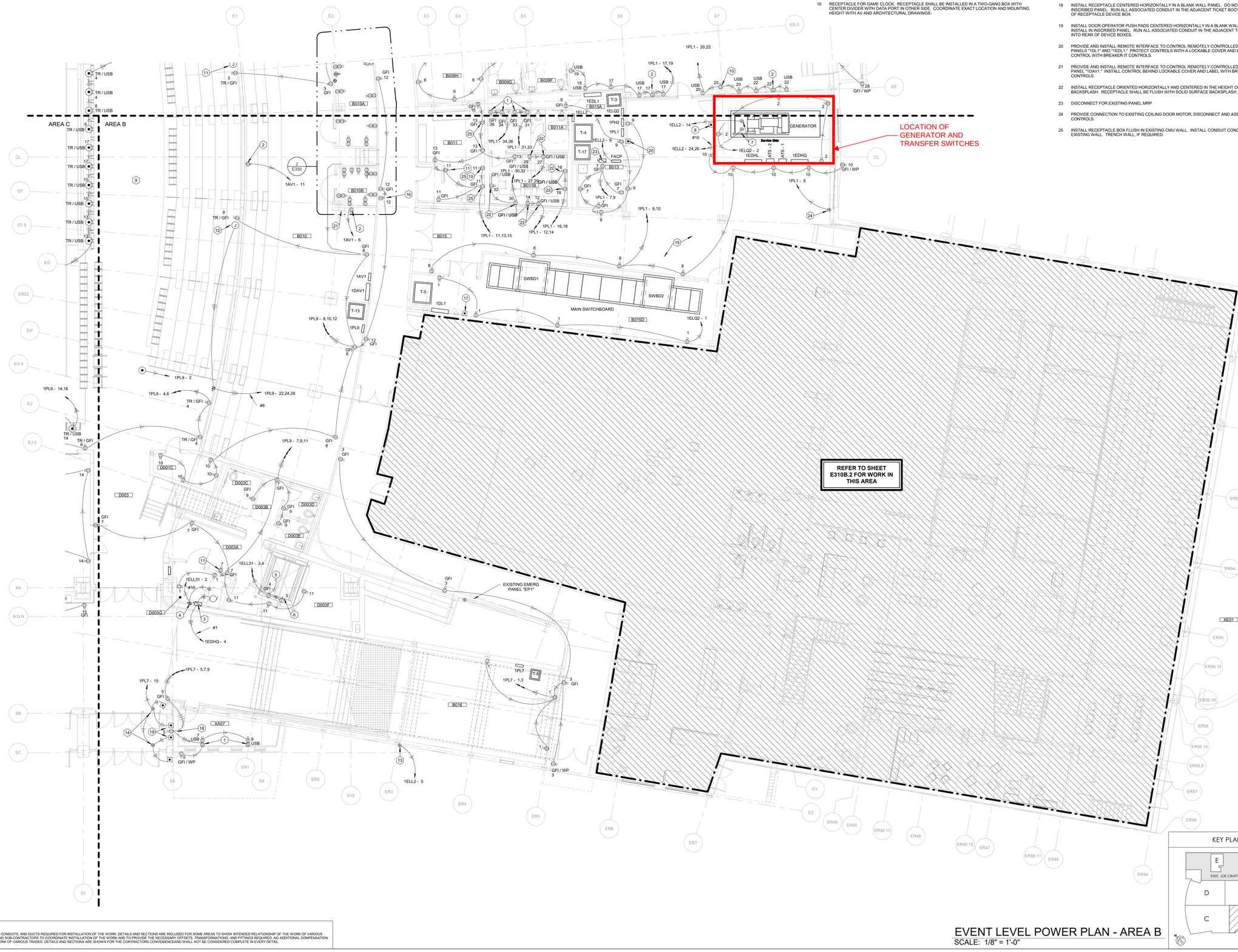
ROOM NUMBER	ROOM NAME
E045B	VISITING TEAM RESTROOM
E045C	VISITING TEAM ICE ROOM
E045D	VISITING TEAM SHOWER ROOM
E047	VISITING TEAM TRAINING ROOM
ELO0-B	ELEVATOR
ELO0-C	ELEVATOR
EL-A	ELEVATOR
PC01	CHASE
ST-C	STAIR
ST-D	STAIR
ST-E	STAIR
ST-F	STAIR
XA01	SATELLITE TICKET OFFICE
XA07	SATELLITE TICKET OFFICE
XE01	EXTERIOR MECHANICAL ENCLOSURE

CODED NOTES:

1. INSTALL RECEPTACLES 2" ABOVE BACKSPLASH/COUNTER. REFER TO ARCHITECTURAL DRAWINGS AND APPROVED CASEWORK SHOP DRAWINGS.
2. PROVIDE AND INSTALL RECEPTACLE FOR BROCAST CABLING ENCLOSURE. REFER TO AV DRAWINGS FOR ADDITIONAL INFORMATION.
3. 100A/3P/600V DISCONNECT WITH DRY AND ISOLATED CONTACTS FOR BATTERY LOWERING. FUSE WITH 80 AMP DUAL ELEMENT TIME DELAY FUSES. PROVIDE CONNECTION TO ELEVATOR CONTROLLER.
4. 30A/2P/240V DISCONNECT. FUSED AT 20 AMPS. PROVIDE CONNECTION TO ELEVATOR CONTROLLER.
5. CONTINUE CIRCUIT TO LIGHT FIXTURE IN ELEVATOR PIT. RECEPTACLE AND LIGHT TO BE ON THE SAME CIRCUIT. REFER TO LIGHTING PLANS.
6. DEDICATED SIMPLEX RECEPTACLE FOR SUMP PUMP IN ELEVATOR PIT. REFER TO PLUMBING DRAWINGS FOR EXACT LOCATION.
7. CONNECT GENERATOR BATTERY CHARGER AND JACKET HEATER CIRCUITS.
8. INSTALL GENERATOR REMOTE ANNUNCIATOR/EMERGENCY STOP AT THIS LOCATION.
9. ALL RECEPTACLES IN THE EVENT FLOOR/GYMNASIUM/ARENA ARE TO BE TAMPERPROOF TYPE.
10. RECEPTACLE FOR GAME CLOCK. RECEPTACLE SHALL BE INSTALLED IN A TWO-GANG BOX WITH CENTER DIVIDER WITH DATA PORT IN OTHER SIDE. COORDINATE EXACT LOCATION AND MOUNTING HEIGHT WITH AV AND ARCHITECTURAL DRAWINGS.

CODED NOTES:

11. INSTALL RECEPTACLE FOR FLAT PANEL DISPLAY. REFER TO ARCHITECTURAL DRAWINGS FOR HEIGHT OF FLAT PANEL DISPLAY. COORDINATE WITH INSTALLER.
12. TERMINATE CIRCUIT IN A JUNCTION BOX FOR CONNECTION TO MOTORIZED BLEACHER SYSTEM. COORDINATE REQUIREMENTS WITH APPROVED SHOP DRAWINGS AND PROVIDE CIRCUIT AS REQUIRED. PROVIDE FINAL CONNECTION TO SINGLE-POINT BLEACHER CONNECTION.
13. PROVIDE 120V CONNECTION TO SPRINKLKER GONG, AS REQUIRED. COORDINATE WITH SPRINKLER CONTRACTOR PRIOR TO ROUGH-IN. CONNECT TO NEAREST 120V CONVENIENCE RECEPTACLE CIRCUIT.
14. MAKE CONNECTIONS TO HANDICAP DOOR OPERATORS AND WALL-MOUNTED PUSH PADS. COORDINATE EXACT LOCATIONS WITH ARCHITECTURAL DRAWINGS. CONCEAL CONDUITS.
15. ELECTRICAL PRIMARY WILL HAVE TO CROSS THE EXISTING UTILITY TUNNEL IN THIS APPROIMATE LOCATION. PROVIDE CONDUIT SUPPORTS, AS REQUIRED.
16. RECEPTACLE FOR DUAL-FACE CLOCK. INSTALL AT ELEVATION SUCH THAT CLOCK WILL BE 4" BELOW CEILING. PROVIDE AND INSTALL DUAL-FACE CLOCK PER SPECIFICATIONS.
17. PROVIDE AND INSTALL REMOTE INTERFACE TO CONTROL REMOTELY CONTROLLED MAIN, TIE, MAIN, AND THREE BRANCH BREAKERS IN "SWBD1" AND "SWBD2" AT THIS LOCATION. INSTALL CONTROLS BEHIND A LOCKABLE COVER AND LABEL EACH CONTROL WITH BREAKER IT CONTROLS.
18. INSTALL RECEPTACLE CENTERED HORIZONTALLY IN A BLANK WALL PANEL. DO NOT INSTALL IN INSCRIBED PANEL. RUN ALL ASSOCIATED CONDUIT IN THE ADJACENT TICKET BOOTH AND INTO REAR OF RECEPTACLE DEVICE BOX.
19. INSTALL DOOR OPERATOR PUSH PADS CENTERED HORIZONTALLY IN A BLANK WALL PANEL. DO NOT INSTALL IN INSCRIBED PANEL. RUN ALL ASSOCIATED CONDUIT IN THE ADJACENT TICKET BOOTH AND INTO REAR OF DEVICE BOXES.
20. PROVIDE AND INSTALL REMOTE INTERFACE TO CONTROL REMOTELY CONTROLLED MAIN BREAKERS IN PANELS "1DL1" AND "1EDL1." PROTECT CONTROLS WITH A LOCKABLE COVER AND LABEL EACH CONTROL WITH BREAKER IT CONTROLS.
21. PROVIDE AND INSTALL REMOTE INTERFACE TO CONTROL REMOTELY CONTROLLED MAIN BREAKER IN PANEL "1DAV1." INSTALL CONTROL BEHIND LOCKABLE COVER AND LABEL WITH BREAKER IT CONTROLS.
22. INSTALL RECEPTACLE ORIENTED HORIZONTALLY AND CENTERED IN THE HEIGHT OF THE 6" COUNTER BACKSPLASH. RECEPTACLE SHALL BE FLUSH WITH SOLID SURFACE BACKSPLASH.
23. DISCONNECT FOR EXISTING PANEL MRP.
24. PROVIDE CONNECTION TO EXISTING COILING DOOR MOTOR, DISCONNECT AND ASSOCIATED CONTROLS.
25. INSTALL RECEPTACLE BOX FLUSH IN EXISTING CMU WALL. INSTALL CONDUIT CONCEALED WITHIN EXISTING WALL. TRENCH WALL, IF REQUIRED.



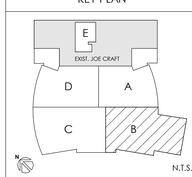
NOTE:

IT IS NOT INTENDED THAT THE PLANS SHOW ALL OFFSETS IN PIPES, CONDUITS, AND DUCTS REQUIRED FOR INSTALLATION OF THE WORK. DETAILS AND SECTIONS ARE INCLUDED FOR SOME AREAS TO SHOW INTENDED RELATIONSHIP OF THE WORK OF VARIOUS TRADES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND SUB-CONTRACTORS TO COORDINATE INSTALLATION OF THE WORK AND TO PROVIDE THE NECESSARY OFFSETS, TRANSFORMATIONS, AND FITTINGS REQUIRED. NO ADDITIONAL COMPENSATION WILL BE ALLOWED FOR CORRECTION CONFLICTS BETWEEN THE WORK OF VARIOUS TRADES. DETAILS AND SECTIONS ARE SHOWN FOR THE CONTRACTORS CONVENIENCEAND SHALL NOT BE CONSIDERED COMPLETE IN EVERY DETAIL.

EVENT LEVEL POWER PLAN - AREA B

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

KEY PLAN



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Email: kfi@kfi-eng.com

NOT FOR CONSTRUCTION

EVENT LEVEL POWER PLAN - AREA B

IMPROVE MEMORIAL COLISEUM
FOR:
THE UNIVERSITY OF KENTUCKY
LEXINGTON, KENTUCKY

Architect of Record:
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UK#: 2520.0
Project No: 1924
Drawn By: ND
Rev'd By: WT

ISSUED FOR:

REVISIONS

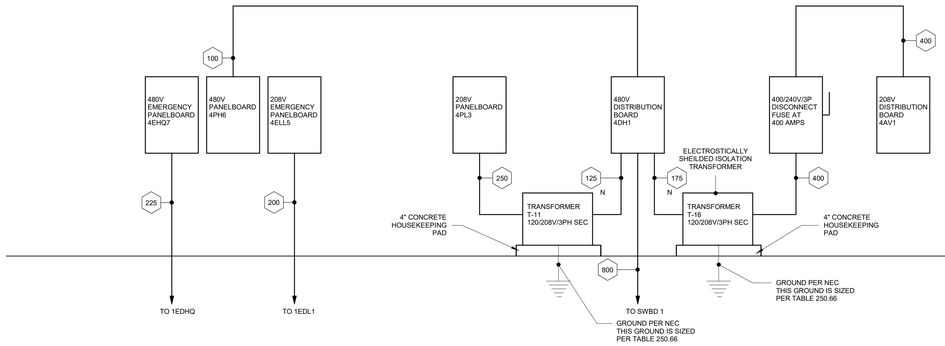
#	DATE	DESCRIPTION

CONSTRUCTION DOCUMENTS

E310B

EVENT LEVEL POWER PLAN - AREA B

DATE ISSUED:
JANUARY 23, 2023



TRANSFORMER SCHEDULE						
TRANSFOMER	PRIMARY VOLTAGE	SECONDARY VOLTAGE	KVA	SUPPLIES	LOCATION	REMARKS
T-1	12,470V/3P	277/480V/3PH/4W	2000 KVA	SWBD	TRANSFORMER B015D	
T-2	12,470V/3P	277/480V/3PH/4W	2000 KVA	SWBD	TRANSFORMER B015D	
T-3	480/3P	120/208V/3PH/4W	75 KVA	1ELQ2	ELECTRICAL B015A	
T-4	480/3P	120/208V/3PH/4W	300 KVA	1ELL2	ELECTRICAL B015A	
T-5	480/3P	120/208V/3PH/4W	500 KVA	1DL1	ELECTRICAL B015A	
T-6	480/3P	120/208V/3PH/4W	30 KVA	1PL7 & 1PL8	MECHANICAL B016	
T-7	480/3P	120/208V/3PH/4W	75 KVA	1PL11 & 1PL12	MECHANICAL B001	
T-8	480/3P	120/208V/3PH/4W	300 KVA	1DL14	UNDER BLEACHER STORAGE E006	
T-9	480/3P	120/208V/3PH/4W	45 KVA	1PL22 & 1PL23	MECHANICAL E003	
T-10	480/3P	120/208V/3PH/4W	75 KVA	1PL24 & 1PL25	MECHANICAL / ELECTRICAL E008	
T-11	480/3P	120/208V/3PH/4W	75 KVA	4DL2	ATTIC MEZZ. D300A	
T-12	480/3P	120/208V/3PH/4W	75 KVA	4DL10	ATTIC MEZZ. A300	
T-13	480/3P	120/208V/3PH/4W	225 KVA	1DAV1	UNDER BLEACHER STORAGE E010	ELECTROSTICALLY SHEILDED ISOLATION TRANSFORMER, K13, 200% NEUTRAL
T-14	480/3P	120/208V/3PH/4W	500 KVA	1DAV2	UNDER BLEACHER STORAGE E006	ELECTROSTICALLY SHEILDED ISOLATION TRANSFORMER, K13, 200% NEUTRAL
T-15	480/3P	120/208V/3PH/4W	45 KVA	2AV1	CONCESSION STORAGE B102	ELECTROSTICALLY SHEILDED ISOLATION TRANSFORMER
T-16	480/3P	120/208V/3PH/4W	112.5 KVA	4AV1	ATTIC MEZZ. D300A	ELECTROSTICALLY SHEILDED ISOLATION TRANSFORMER
T-17	480/3P	120/208V/3PH/4W	225 KVA	EXISTING MRP	TRANSFORMER B015D	

SPECIAL NOTE:

RUN AN ISOLATED GROUND IN FEEDERS TO TO ALL "AV" DISTRIBUTION BOARDS AND PANELBOARDS. THESE BOARDS HAVE "AV" IN THEIR NAMES.

FEEDER AND BRANCH CIRCUIT SCHEDULE

NO.	CONDUCTORS THWN/THHN COPPER
20	4#12 & 1#12 GND. IN 3/4" CONDUIT.
30	4#10 & 1#10 GND. IN 3/4" CONDUIT.
40	4#8 & 1#10 GND. IN 1" CONDUIT.
45	4#6 & 1#10 GND. IN 1" CONDUIT.
50	4#6 & 1#10 GND. IN 1" CONDUIT.
60	4#4 & 1#8 GND. IN 1" CONDUIT.
70	4#4 & 1#8 GND. IN 1-1/4" CONDUIT.
80	4#3 & 1#8 GND. IN 1-1/4" CONDUIT.
90	4#2 & 1#8 GND. IN 1-1/4" CONDUIT.
100	4#1 & 1#6 GND. IN 1-1/2" CONDUIT.
110	4#1 & 1#6 GND. IN 1-1/2" CONDUIT.
125	4#1 & 1#6 GND. IN 1-1/2" CONDUIT.
150	4#1/0 & 1#6 GND. IN 2" CONDUIT.
175	4#2/0 & 1#6 GND. IN 2" CONDUIT.
200	4#3/0 & 1#6 GND. IN 2" CONDUIT.
225	4#4/0 & 1#4 GND. IN 2-1/2" CONDUIT.
250	4-250MCM & 1#4 GND. IN 3" CONDUIT.
300	4-350MCM & 1#3 GND. IN 3" CONDUIT.
350	4-500MCM & 1#2 GND. IN 3-1/2" CONDUIT.
400	4-500MCM & 1#3 GND. IN 3-1/2" CONDUIT.
500	4-250MCM & 1#2 GND. IN EACH OF TWO (2) 2-1/2" CONDUITS.
600	4-350MCM & 1#1 GND. IN EACH OF TWO (2) 3" CONDUITS.
700	4-500MCM & 1#1/0 GND. IN EACH OF TWO (2) 3-1/2" CONDUITS.
800	4-500MCM & 1#1/0 GND. IN EACH OF TWO (2) 3 1/2" CONDUITS.
900	4-350MCM & 1#2/0 GND. IN EACH OF THREE (3) 3" CONDUITS.
1000	4-400MCM & 1#3/0 GND. IN EACH OF THREE (3) 3-1/2" CONDUITS.
1200	4-350MCM & 1#3/0 GND. IN EACH OF FOUR (4) 3" CONDUITS.
1400	4-500MCM & 1#4/0 GND. IN EACH OF FOUR (4) 3-1/2" CONDUITS.
1600	4-500MCM & 1#4/0 GND. IN EACH OF FIVE (5) 3-1/2" CONDUITS.
1800	4-500MCM & 1-250MCM GND. IN EACH OF FIVE (5) 3-1/2" CONDUITS.
2000	4-500MCM & 1-250MCM GND. IN EACH OF SIX (6) 3-1/2" CONDUITS.
2200	4-500MCM & 1-350MCM GND. IN EACH OF SEVEN (7) 3-1/2" CONDUITS.
2400	4-500MCM & 1-500MCM GND. IN EACH OF ELEVEN (11) 3-1/2" CONDUITS.

20 N — DESIGNATES THAT THE NEUTRAL CONDUCTOR IS NOT REQUIRED.

ADJUST QUANTITY OF WIRES FOR BRANCH CIRCUITS IN ACCORDANCE WITH CIRCUIT BREAKER SIZE SHOWN IN PANEL SCHEDULES.

INCREASE WIRE SIZE TO THE NEXT WIRE SIZE FOR BRANCH CIRCUITS OVER 150 FEET.

INCREASE WIRE SIZE TO NEXT WIRE SIZE FOR EVERY ADDITIONAL 150 FEET.

ELECTRICAL DISTRIBUTION SYSTEM RISER DIAGRAM - EAST

SCALE: NONE

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NOT FOR CONSTRUCTION

ELECTRICAL DISTRIBUTION SYSTEM RISER DIAGRAM - EAST

IMPROVE MEMORIAL COLISEUM

FOR:

THE UNIVERSITY OF KENTUCKY

LEXINGTON, KENTUCKY

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Landscape Architect:
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UK# 2520.0

Project No: 1924
Drawn By: ND
Rev'd By: WT

ISSUED FOR:

REVISIONS

#	DATE	DESCRIPTION

CONSTRUCTION DOCUMENTS

E500

ELECTRICAL DISTRIBUTION SYSTEM RISER DIAGRAM - EAST

DATE ISSUED:
JANUARY 23, 2023

Specification Index

Drawing Index

Item No.	Item Rev.	Package No.	Package Rev.	Description	Reference No.
				AHU Warranty	Closeout
				AHU O&M	Closeout

SECTION 237323 – CUSTOM AIR-HANDLING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The air handlers, shipping to site and factory startup will be purchased through RFP and furnished to the contractor for installation.

1.3 SCOPE

A. The specifications describe the work to be done and the materials to be provided for furnishing custom air-handling units.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for the custom air-handling unit specified, which includes the following:

1. Brief description of each unit section layout including type of floor, walls, insulation, base frame, access doors, windows in access door, door latches, lights, electrical devices, pressure gauges, thermometers and drain pans.
2. For all fans:
    a. Fan manufacturer, arrangement, rotation, class and optional accessories (inlet screen, protection cages and etc.)
    b. Certified fan-performance curves with system operating conditions indicated.
    c. Certified fan-sound power ratings.
3. Sound absorption criteria and sound transmission loss data for Octave Bands 1 through 7 for wall and roof panels with perforated interior skins.
4. Lights/GFI/Switches with construction and electrical characteristics.
5. Certified coil-performance ratings with system operating conditions indicated.
6. Motor ratings and electrical characteristics plus motor and fan accessories.
7. Material gages and finishes.
8. Filter Frame construction including size and shape of holding clips or clamps.
9. Dampers, including housings, linkages. Indicate on the shop drawings the future location of the actuators (actuators are to be provided by others.)
10. Access Doors to be used.
11. Flexible Connections for the fans: type and manufacturer’s specification sheet
12. Vibration isolators: construction, load ranges, layout with dimensions.
13. Magnehelic Gages: Type and manufacturer specification sheet.
14. Thermometers: Type and manufacturer’s specification sheet.

15. Floor Drains: Type and accessories.

C. Shop Drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection. The shop drawings shall clearly show the location of each wall face and type of face, being perforated or solid. The routing of the motor conduits from the motor pecker head to the junction box shall be shown on the shop drawing. If the unit cannot be shipped in a single package, indicate on a drawing how the unit will be broken down for shipping and how the unit will be reassembled on the jobsite. Show the location of each floor drain and routing of the drain piping.

D. ALL UNIT SHOP DRAWINGS ARE TO BE DRAWN TO A MINIMUM SCALE OF 1/4" = 1'-0".

E. Shop drawing details: Include in the submittal, the following details:

1. Wall construction, both perforated and solid wall faces.
2. Floor and roof construction
3. Piping arrangement for each component
4. Trolley beam and coil pull ring assemblies
5. For each fan type - fan, inertia base, seismic restraints, and support structure for each coil type – coil support assembly, method of attachment of the moisture eliminator to the coil, drain pan (indicating direction of slope), size of condensate drainage piping
6. Shipping split assembly

F. Wiring diagrams detailing wiring for power and control systems and differentiating between manufacturer-installed and field-installed wiring.

G. Welding Certificates: Provide certification of individuals who will be welding the piping in accordance to ASME Code, Section IX as required by the Commonwealth of Kentucky, Department of Housing, Building and Construction, Office of State Fire marshal Boiler Inspection Section (Boiler and Pressure Vessel and Pressure Piping Law).

H. Include maintenance data for custom air-handling unit in the operation and maintenance manual.

1.5 QUALITY ASSURANCE

A. NFPA Compliance: Custom air-handling unit and components shall be designed, fabricated, and installed in compliance with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."

B. Comply with current issue of the Kentucky Building Code.

C. Comply with NFPA 70 for components and installation.

D. All materials and devices used in the construction and operation of the custom air handling unit shall not exceed a flame spread index of 25 and a smoke developed index of 50.

E. Listing and Labeling: Provide electrically operated components specified in this Section that are listed and labeled.

F. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

G. UL and NEMA Compliance: Provide motors required as part of air-handling unit that are listed and labeled by UL and comply with applicable NEMA standards.

H. ETL Certification:

1. Provide an additional breakout price for ETL Certification.

I. Compliance with Kentucky Boiler and Pressure Vessel and Pressure Piping Law: All welds on the hot water and steam systems are to be done by a certified welder fulfilling the requirement of ASME Code, Section IX (KY Boiler Code: New Installations – 815 KAR 15:025, Section 1. Minimum Standards) and is to be inspected by the Commonwealth of Kentucky Department of Housing, Buildings and Construction for compliance.

J. Listing and Labeling Agency Qualifications:

1. A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA. Regulation 1910.7.

K. Coordination: Coordinate layout and installation of central-station air-handling units with piping and ductwork and with other installations.

L. Factory Inspection / Testing:

1. The air handling unit shall be assembled at the factory, inspected, and determined to be in compliance with the specifications. Any deviations found shall be corrected before shipment.
2. The air handling unit, including all of its components and accessories, shall be operationally tested at the factory and certified to comply with all requirements of the specification.
3. Factory testing shall be executed only after all floor drains, piping and electrical penetrations have been cut. Openings can be temporarily blanked off or plugged as required. Floor drains must be in place and the piping capped at the perimeter base of the unit.
4. Each cooling coil drain pan shall be tested for leaks and proper sloping. A coil drainage test will be applied to each cooling coil drain pan. The coil drain pan test will be as follows. Before each test, the unit floor will be verified to be level. Each drain pan will be continuously filled with water and the drainage is to be observed. The filling of water will be discontinued at which time the drain pan will be observed to whether it holds any water after a ½ minute time period. Any defects or failure to satisfy the drain pan test will require immediate correction in the presence of the owner's representative. Upon these corrections, the condition that generated the failure is to be tested again to owner's representative's satisfaction.
5. All the air handling unit electrical devices including but not limited to lights, fan motors, and GFI electrical receptacles shall be energized and tested to insure operational integrity prior to unit shipment and in the present of the owner's representative.
6. All fans shall have a dynamic balance performed after assembly. An IRD or PMC analyzer shall be used to measure velocity. The final reading shall not exceed 0.1 inch per 10 second vertically or horizontal at the bearing caps nor exceed 0.09 inches per second in the axial direction. The exact level of vibration shall be recorded in a legible form in the operation and maintenance manual as proof of the dynamic balance at the factory.
7. All fans are to be performance tested. Each duct opening shall be partially blocked to impose a static pressure drop equal to the design pressure drop of the ductwork. Each filter section shall be partially blocked to impose a static pressure drop equal to the scheduled final static pressure drop.
8. All fans are to be ramped up to the air flow rate requirements as listed on the contract drawing documents. When these conditions are met, the brake horsepower of the motor and the static pressure drop across each component is to be measured. The measured motor brake horsepower, fan total pressure and fan cfm are to be compared to the manufacturer's fan curve. The fan cfm is to be within -5% or greater than the scheduled fan cfm with the motor hp to be within -5% or less.
9. If the unit does not satisfy the requirements, the manufacturer will be required to diagnose the problem and repair or modify as required to meet the design conditions.

M. Warranty

1. The air handling unit manufacturer shall provide the parts warranty for equipment manufactured by them and all vendor supplied components. Said warranty shall cover replacement of all defective

parts for a 12 month period after the architect issues a substantial completion declaration of the portion of the project the air handling unit serves.

2. Prior to the warranty period, the manufacturer's representative is to be responsible for monthly inspection and maintenance while the unit is in this transition time period. The monthly inspection is to include but not limited to the following

    a. Check to insure protective coil connection caps are in place,
    b. Verify the unit is stored in a manner that is acceptable to the custom air handling unit manufacturer,
    c. Perform a long term fan storage procedure as recommended by the fan manufacturer (similar to Twin City Engineering Supplement ES-201). Some of the procedures include but not limited to - rotation of the fan wheel and the greasing of the bearings with the fan impeller being left at approximately 180 degrees from that of the previous month to prevent the shaft and impeller from taking a set in one position.
    d. Verify unit is clean. Cleaning is the responsible of the construction manager.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prior to shipment, all coils shall be degreased to remove oil and all coil fins shall be combed straight. Connections to coils shall have threaded protectors (caps or plugs) furnished on the coil connections. All items shipped loose such as filters, steam humidifier assemblies, caulking, etc. shall be itemized on the shipping ticket and be suitably secured in the unit or on a separate pallet. All duct connections shall be covered with plywood or sheet metal caps. All equipment shall be delivered to the job site suitably packaged and protected for overland trucking and for storing the equipment outside exposed to the weather.

B. Work out a shipping schedule of priority with the Construction Manager, which shall determine the manufacturing and delivery sequence.

C. Building constraints, unit size and trucking limitations will require that units be shipped in more than one piece. Limit the maximum weight of any piece to 20,000# unless directed otherwise by the Construction Manager. Coordinate maximum size restraints with the Construction Manager. Indicate all split points on the shop drawings.

D. All vibration isolated components shall be suitably restrained before shipment.

E. The manufacturer is responsible for providing lift and support points on each units for rigging and positioning of the unit to its final destination. Clearly indicate the maximum load that can be imposed on any lift or support point.

F. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate size and location of concrete housekeeping bases.

B. Coordinate size and location of structural-steel support members.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed. These extra materials are to be packaged with protective covering for storage, and are identified with labels describing contents.

1. Filters: Furnish 1 set for each pre-filter bank of the custom air-handling unit.
2. Trolley: One Coffing Trolley or equal capable of supporting twice the expected load.

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:

1. Air Enterprises
2. Air Flow Equipment Company
3. ClimateCraft
4. Governaire
5. TMI Custom Solutions
6. Webco, Inc.

2.2 GENERAL:

A. Air handling units shall be of the type and arrangement as shown on the drawings and as described in the specifications. The unit manufacturer shall accept total responsibility for the construction and performance of the complete air handling unit including all components. Unit performance shall be as shown on the equipment schedules.

B. The general design of each unit shall consist of heavy duty mill galvanized unit casing mounted on an all welded structural steel channel and I-beam base. All parts of the air handling unit shall be manufactured of galvanized steel, except where otherwise noted differently in the specification or drawings. All interior and exterior parts of the fan, channel base, and other bracing, shall be coated with a lead and chromate-free oxide alkyd primer.

2.3 WALL AND ROOF PANEL CONSTRUCTION

A. The air handling systems shall be a minimum of 3” double wall thermal break type construction, capable of preventing water vapor condensation on exterior surfaces. Systems shall also be capable of preventing water vapor condensation on the interior walls, floors and ceilings.

B. The air handling unit wall structural framing system shall be a rigid structure capable of handling all dead loads and 1.5 times the operating pressure of the unit. The structural framing system shall limit casing deflection to 1/200th of the span of each casing panel at the design loading.

C. Walls of the air handling unit shall be wipe down construction.

D. The air handling unit exterior skin shall be constructed of 16 gauge galvanized steel. The internal skin shall be 20 gauge galvanized steel, 20 gauge aluminum, or 20 gauge stainless steel, unless otherwise indicated in the contract documents. All skins using galvanized steel shall be G90 hot dip processed zinc coated (0.90 oz/sq ft minimum) and conform to ASTM 527 for panels of 16 gauge and lighter and ASTM 526 for panels of 14 gauge and heavier.

1. Interior liners in cooling coil sections shall be a minimum 20-gauge 304 stainless steel.

E. Exterior seams shall be sealed with Hardcast fabric tape and caulked with a FTA-20 acrylic sealant (or equal) to provide a smooth surface to eliminate air and water vapor leakage.

F. Interior walls (being walls with both skins in contact with the air stream) separating the air handling unit sections shall be attached to the air handling casing walls at a casing panel joint or equal construction to prevent air bypass. The interior wall shall be sealed at the casing panel with a FTA-20 acrylic sealant or equal.

G. Provide solid or perforated inner faces on the internal skin of the casing and the internal walls of the air-handling unit as indicated on the drawings. Construct the perforated inner face of aluminum or stainless steel as specified on the drawings. Attach the inner face to the structural members in such a way as to prevent any dissimilar metal corrosion. On the any wall of the air-handling unit, both skins shall not have perforated inner faces.

H. Insulation

1. All wall and roof panels shall be insulated with an injected foam insulation with a minumum R value of 6.6/inch. The composite R-value of the 3" unit casing shall be no less than R-19.8. This construction shall be applicable between the interior and exterior skin of the casing and between the two skins of the internal walls of the air handling unit.
2. Insulation shall be inert, vermin proof, and moisture proof.
3. Insulating materials shall meet the requirements of NFPA-90A. The unit casing, including outside casing, inside casing, insulation and polymer covering shall meet 25/50 Flame/Smoke Rating as a composite unit.
4. No insulation shall be exposed to the air-stream. For perforated inner face type panels, provide polymer encased insulation and minimum standoffs in casing panels to prevent polymer covering from coming into contact with perforated inner face.
5. For solid inner face type panels, the insulation does not have to be encased in a polymer covering.
6. Minimum acoustical absorption coefficients for perforated panel walls with polymer encased insulation shall be as follows:

FREQUENCY (CPS)

125	250	500	1000	2000	4000
0.52	0.37	0.64	0.60	0.56	0.29

7. The total noise reduction coefficient of the insulation and the perforated panel as a unit shall by 0.55.

I. Bellmouth Entrances:

1. Provide bellmouth entrances as indicated on the drawings. Construct of same material used for inner skin of the surrounding panel. Provide a minimum bellmouth radius to duct diameter ratio of 0.16 in duct diameters up to 48 inches and 0.08 for diameters larger than 48 inches.
2. Braze bell-mouth fittings into the panels. Panels shall be properly reinforced to accommodate the bell-mouth and retain them solidly in the panels. Attach the radiused end of the bellmouth entrance to the inside face of the panel.

J. Hoist and trolley (required for motors or components over 200 lbs)

1. A mono-directional trolley system shall be provided, to facilitate removal and/or installation of fan/motor components. The trolley shall be completely supported from the base structure and shall be constructed of structural steel tube for vertical support and structural steel I-beam for horizontal cross members. The main hoist trolley beam shall be constructed of tapered flange I-beam and shall be hung underneath of the structural support frame. All structural steel shall be ASTM A-36.

2. The trolleys shall be constructed of heavy-duty design complete with hardened pressed steel wheels with double row ball bearings. Side plates shall extend beyond wheels to act as a bumper. Trolley shall be similar to Coffing Model CBT, rated for 1-1/2 tons.
3. Monorail systems shall have a marked capacity of 1-1/2 Ton.
4. Monorail systems shall comply with all state and federal regulations and be constructed per ASME B29.24M, HST-2M, B30.11 and ANSI MH27.1 as directed for hand operated hoists. All design calculations shall comply with the MANUAL OF STEEL CONSTRUCTION . All hoists and monorails shall be tested at 125% of the rated maximum capacity. A certified test report shall be provided for each hoist and monorail.
5. Stencil on the jib crane, ”MAXIMUM DESIGN LOAD IS ….. TONS.”

K. Removable Access Panels:

1. Provide removable access panels where component removal is not possible through an access door.
2. Components requiring an access panel include but are not limited to the damper(s), fan(s), motor(s), and coil(s). Removable panels shall be the same construction as the housing as described above.
3. In locations were the coil can not be directly removed from the side of the unit through a coil pull panel, the exterior side of the entire unit section shall be removable and the access door shall be installed within that removable section.

L. Access Doors:

1. Provide a 3”, double wall insulated heavy-duty access doors with frames in all section and at additional locations shown on contract documents. Door material and gauges shall be the same as the wall in which it is installed. Each door shall be of thermal break construction.
2. The insulation within the door shall be 2” of 3-lb/cu ft fiberglass that is moisture and vermin proof.
3. Construct the door to prevent any insulation from contacting the air stream. Each door shall be dual gasketed, one on each side of the thermal break, mounted in a mating slot in the extruded aluminum doorframe. The frame shall have welded mitered corners.
4. The gasket shall be wrapped around the full perimeter of the door. Provide a minimum of two Vent Lock #260 or equal cast aluminum handles and a full-length stainless steel piano hinge. The hinge and the method of attaching the hinge on to the unit shall be strong enough to handle 1.5 times the operating pressure of the section that the access door is attached to.
5. Provide a double-thickness, airtight, plexiglass deadlite window in each door. Mount windows at eye level when viewing from the exterior of the unit.
6. Doors shall open against unit operating pressure. Positive pressure sections shall have inwardly opening doors. Negative pressure sections shall have outwardly opening doors.

M. Finishes:

1. Painting is not required for galvanized, aluminum or stainless steel external skins.
2. For other systems, clean scale, rust, weld splatter and other foreign substances off surfaces. Clean and paint structural members with a primer. Paint external skins with primer and an alkyd enamel finish. The owner’s representative shall select color.
3. Paint floors including the floor under the drain pan with a black epoxy enamel.

2.4 UNIT BASE:

A. Construct all unit components on a fully welded structural steel base utilizing C-channels for the perimeter and wide flange cross members on 24” - 30” centers. Roll-formed or fabricated structural members are not acceptable. The minimum size of the base channel is to be 6" in depth.

B. The base shall be suitable for rigging and handling of each section of the unit.

C. Provide welded lifting lugs at each section corner.

D. Clean the unit base and prime with zinc chromate primer. Finish with a rust inhibiting exterior enamel or equal

2.5 FLOOR CONSTRUCTION:

A. Shall be fabricated of 3/16″ aluminum tread plate. All floor sheets shall be mechanically fastened to the unit base structure and isolated from the base assembly with an EPDM thermal break gasket.

B. Floors shall be insulated with a two-part polyurethane water impervious foam insulation. A 20-gauge G90 galvanized steel under liner shall be provided.

C. Provide each section of the air handling unit with a floor drain piped through the perimeter base to the outside of the unit with a ball valve and a threaded cap. The pipe from the floor drains shall be on the same side of the unit as the cooling coil condensate drain or as indicated on the drawings. Floor drains shall be located at the lowest elevation of the unit's floor as specified on the drawings. Weld floor drains to the floor so as to not compromise the leak-proof integrity of the floor.

2.6 DAMPERS:

A. Damper operators will be provided by the control systems contractor and are not a part of the custom air handling unit.

B. Provide automatic control dampers as indicated, with damper frames not less than 13 gage galvanized steel. Provide mounting holes for enclosed duct mounting. Provide airfoil shaped damper blades not less than formed 14 gage, with maximum blade width of 6". Provide industrial type dampers capable of withstanding 12" W.G. static pressure.

C. Secure blades to zinc-plated axles using zinc-plated hardware. Seal off against spring stainless steel blade bearings.

D. Provide blade bearings of nylon and provide thrust bearings at each end of every blade. Construct blade linkage hardware of zinc-plated steel and, brass. Submit leakage and flow characteristics plus size schedule for each damper.

E. Damper shaft sizes are to be in accordance to the static pressures to which they are operating against. Minimum shaft size is 3/4" in diameter. The maximum velocity through the damper is to be no more than 66% of the maximum velocity rating of the damper.

F. Provide opposed blade dampers.

G. Do not exceed a maximum 60"x60" damper size. For sizes larger than the maximum in either dimension, use multiple dampers with a separate operator for each damper. Do not link separate dampers together. Jack shafting the dampers is not acceptable.

H. Operating Temperature Range: From -20 degrees to 200 degrees F. (-29 degrees to 93 degrees C.)

I. Provide dampers with inflatable steel blade edging, or replaceable rubber seals, rated for leakage less than 10 CFM/sq.ft. of damper area, at differential pressure of 12" w.g.

J. Fan Isolation Dampers: Fan isolation dampers that are installed on the discharge of the fan shall have the blades mounted in the vertical position. Fan isolation dampers that are installed on the intake size of the fan shall have blades mounted in the horizontal position.

K. Gravity operated shutters at fan inlets or discharges shall meet damper specifications and have counterbalanced mechanisms to close them when their respective fans shut down.

2.7 AIR BLENDERS (AHU-3 & AHU-4 ONLY):

A. Air blenders shall be constructed of 0.08 gauge aluminum all welded construction. Blender shall consist of blade deflectors to prevent stratification and to provide equal air distribution through coils.

B. The blender shall be capable of providing a minimum mixing effectiveness of 80% when mixing 50% of 0 deg.F. cold air with 50% of 75 deg.F. warm air. The associated maximum temperature standard deviation through a plane parallel with the blender at the discharge of the mixing box shall be 6 deg.F. with 60 deg.F. difference between entering air streams.

C. The unit shall have provisions for floor or ceiling mounting.

D. Where multiple blenders are provided, they shall be arranged to eliminate stratification.

2.8 COILS – STEAM

1. See Section 23 8216.12 – “Steam Air Coils”

2.9 COILS - WATER:

A. Each coil shall be independently supported by a stainless steel rack for cooling coil or a galvanized steel rack for heating coils or energy recovery coils to allow for individual coil removal. Individual coil removal shall not require the dismantling of upstream or downstream components. Coil casings shall not be utilized as structural support for stacked coils. Each rack shall extend 6” past the header coil connections and 6” past the U-bends/coil casing.

B. Coils shall be removable through the unit casing through access doors and removable access panels. Removable access panels shall be large enough to allow a minimum of 3 inches of clearance on either size of the coil.

C. Coils shall be rated in accordance with ARI 410-81 and shall meet the specified performance.

D. Coils shall be 5/8” OD, 0.035” copper tube with 0.0095” aluminum plate fin, coil fins shall be the continuous plate type.

E. Coil headers shall be 0.049” thick copper pipe with brazed joints.

F. Coils that do not condense water vapor shall have 12 gauge-galvanized steel casings. Coils that do condense water vapor shall have 12 gauge-stainless steel casings (example: cooling coil).

G. Coils over 72” but under 96" in length shall have a support at the midpoint position along the length of the coil. Coils over 96” in length shall have two tube supports located at 1/3 & 2/3 positions along the length of the coil. The tube supports shall be hot-dipped galvanized steel for coils that do not condense water vapor and stainless steel for coils that do condense water vapor.

H. Provide each coil with (not shipped loose), a manual air vent on top of each header and a drain at the bottom of each header. Provide both the air vent and drain with a 1/2” ball valve. Install the air vent and drain valve as shown on the drawing details. Install both the drain valve and air vent so that the handle of valve can swing from the full open to the full closed position.

I. Extend pipe connections, except for the manual air vents and coil header drains through the unit casing to the exterior of the unit. Seal airtight all pipe penetrations through the unit casing. Pipe penetrations at the jobsite are not allowed.

J. Provide unions (for pipe sizes less than or equal to 2”) or Flanges (for pipe sizes 2-1/2” or larger) inside the unit at the coil headers for future coil removal.

K. The supply and return connections shall be on the same end of the coil.

L. Coil connections shall be flanged for sizes larger than 2” and threaded for sizes less than 2”.

M. Provide threaded or flanged plastic protectors (caps) on connections outside of the air handling unit before shipment.

N. Coils shall be designed for a working pressure of 200 psi and be factory tested at 250 psi of air under water.

O. Fasten cooling coils and drain pans to air handling unit sections all around perimeter of air handling unit sections. Seal off airtight so that all air passes through the cooling coils. Use panel wall construction to seal off cooling coils. Single wall metal safing is not acceptable.

P. Seal space between cooling coils and drain pans so that no air bypasses under cooling coils.

Q. All cooling coil, heat recovery coil, and humidifier sections shall include a double sloped drain pan constructed from 304L stainless steel. All corners shall be welded watertight. Coils shall rest on stainless steel supports. The pan shall have a minimum pitch of 2" from high point to the bottom of the drain outlet connection, providing at least a 1/8” per foot slope. The drain pan shall be insulated with a 2-part sprayed on polyurethane, water impervious foam. Insulation shall be applied to the entire under side of the drain pan and coil section base assembly. If multiple stacked coils are used, intermediate drain pans are required. Intermediate pans shall be insulated and drained with 3/4” copper down-comers to the main pan. Floor drain pans shall be covered with a removable aluminum grating that can we stood on for maintenance.

2.10 COOLING COIL DRAIN PANS

A. Primary drain pans: Provide a 1-1/2” minimum depth, sloped full-length drain pan under each cooling coil section. Each coil shall have one and only one drain pan. Multiple drain pans per coil are not acceptable. Drain pans shall be 16 gauge fully welded 304 stainless steel insulated pans.

1. Mount primary pans above the floor, with the drain connection at 18” minimum above the bottom of the unit. Pans shall not be a part of the floor system.
2. Pans shall extend 4” upstream of the coil assembly to 12” minimum downstream of the assembly. The primary pan shall extend a minimum of 6” past the coil headers and 6” past the coil U-bends and coil casing.
3. The entire pan shall be positively double-sloped towards the condensate outlet at a minimum of ¼” per 1’-0”.
4. The condensate drain shall be a 1-1/2” MPT 304 stainless steel. Locate the outlet on the bottom and at the lowest elevation of the pan.

B. Secondary drain pans: Provide 1” minimum depth intermediate drains pans where cooling coils are stacked. Drain pans shall be 16 gauge fully welded 304 stainless steel insulated pans. Pans shall extend 4” upstream

to 12” downstream of the coil assembly. Pans shall extend 6” beyond the coil header connections and 6” beyond the U-bends and coil casing.

1. The drain pans shall be positively sloped towards the low points with a minimum slope of *¼”* per foot.
2. Down-comers: Provide pans with 1-1/4” down-comers of either Type 304 stainless steel or type M copper, draining to the lowest drain pan. The down-comer connections to the pan shall be free of burrs and mounted flush with the pan. There shall be a minimum of two down-comers per secondary drain pan, one on each end of the maximum length dimension of the drain pan.

C. Provide a plastic protection channel over the top of the insulation and the top lip of each drain pan.

2.11 CENTRIFUGAL FANS

A. FAN ASSEMBLIES – GENERAL

1. The fan shall be of the size and type specified in the unit schedule. To assure maximum performance, fans shall be supplied by a manufacturer specializing in fan design and production.
2. All fan assemblies shall be designed for heavy-duty industrial applications. Fan framing assemblies shall be fabricated from structural steel electrically welded to form a rigid, integral base. Individual fan assemblies shall be independently isolated.
3. All motors shall be NEMA design B with Class F insulation. Electrical characteristics and horsepower shall be as specified on the project schedule. All motors shall have a minimum service factor of 1.15. Motors shall have ball bearings. Motors shall be premium efficiency ODP type and shall be factory wired to a fan array motor overload panel. The motor shall be located within the unit and mounted on an adjustable heavy steel base. The motor base shall be fastened securely to the structural steel framing of the fan assembly.
4. All fans shall meet the minimum efficiency and maximum brake horsepower values as scheduled. All fans shall be selected to operate at a point no higher than 90% of the peak static pressure rating as defined by the fan performance curve at the selected operating speed. Manufacturer must ensure maximum fan RPM is below the first critical speed.
5. Each fan shall be provided with a factory installed airflow measuring device. Airflow device to be mounted out of the direct air stream so as not to affect system static pressure or sound performance. Sensor accuracy shall be +/- 3%. Factory installed assembly shall include flow sensors for field connection to a transducer provided by others.

B. FAN ASSEMBLIES – DIRECT DRIVE FAN ARRAY

1. Fan Arrays shall be direct-drive, non-overloading SWSI plenum fans designed for industrial duty and suitable for continuous operation.

    a. Fans shall be arranged in an array using one or more welded structural steel assemblies and shall be of the size and quantity specified in the unit schedule. Screwed or riveted frames are unacceptable. Fan assemblies shall be attached directly to base structural members.
    b. Fan wheels shall have a minimum of 12 airfoil blades for superior sound characteristics and shall be constructed of aluminum to reduce rotational weight and vibration. Fan blades shall be extruded aluminum for uniformity and improved vibration characteristics. Fan wheels that have less than 12 airfoil blades are not acceptable.
    c. Each fan and motor assembly shall be independently isolated within the structural assembly using 1-inch deflection spring isolators. Isolators shall be mounted in a three-point arrangement that provides both vertical and horizontal (thrust) isolation and shall not require field adjustment. If hard mounted or rubber in shear is used in place of internal spring isolations, external isolation of the entire air handling unit is required, no exceptions.

d. A fan inertia base shall be provided or the fan structure shall exceed an equivalence of 2x mass of the total rotating parts of the fan array. Fan and motor assemblies shall be designed such that no natural frequencies exist within the operating RPM range of the fan, eliminating the need for “lockout” frequency settings in the variable speed drive. The installing contractor will be responsible for all costs associated with externally isolating any unit that does not include individual fan isolation.
e. All fan arrays shall meet the minimum motor efficiency, maximum brake horsepower and total motor horsepower values scheduled. All fans shall be selected to operate at a point no higher than 90% of the peak static pressure rating as defined by the fan performance curve at the selected operating speed. Manufacturer must ensure maximum fan RPM is below the first critical speed. Fans shall be Class 2 or Class 3 construction as required for the application.
f. All fan and motor assemblies shall be dynamically balanced by the manufacturer to a maximum allowable vibration of 0.040 inches per second at design RPM and a maximum 0.080 inches per second overall vibration limit to bring the fan balance in conformance to a BV-5 Grade G1 per ANSI/AMCA 204. In addition, the manufacturer shall insure that no critical frequencies exist in the fan operating range by varying motor speed in 1Hz increments from design RPM to 50% of design RPM.

2. Supply Fan Array Unloading

a. Supply fan arrays shall be provided with unloading capability to allow fan modulation without surge from 100% to 40% of design airflow. There shall be no static pressure or intake plenum losses or any horsepower penalty associated with the system.
b. They system shall provide a positive shutoff for each fan in case of a fan failure. Each fan shall be provided with an isolation or backdraft damper to prevent bypass in the event of a motor failure. Blank off plates requiring manual installation are not acceptable.
c. Fan curves shall be submitted; with the system curve indicating the minimum system operating static pressure and the point of fan surge.

C. Wheels

1. Airfoil-Fan Wheels: Steel or aluminum construction with smooth-curved inlet flange; heavy back plate; hollow die-formed, airfoil-shaped blades continuously welded at tip flange and back plate; cast-iron or cast-steel hub riveted to back plate and fastened to shaft with set screws.

D. Shafts

1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
2. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

E. Bearings

1. Grease-Lubricated Shaft Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.

a. Ball-Bearing Rating Life: ABMA 9, L_{10} of 120,000 hours.
b. Roller-Bearing Rating Life: ABMA 11, L_{10} of 120,000 hours.

F. Fan Array Controls

1. Fan arrays shall be controlled using a common control signal, such as the duct static control signal, to modulate the fan speed.
2. Each fan array in the air handling unit shall be provided with an airflow measuring system. Using one air flow measuring device and multiplying by the number of fans provided is not acceptable due to lack of accuracy.
3. The central processor shall be able to detect and report a fan failure. Auxiliary contacts on the motors starters are not acceptable as fans can fail without tripping overloads. Current sensors wired into the central processors can be utilized.
4. A BACnet communication interface shall be provided to allow the BAS contractor to view the following. The BACnet interface shall be capable of the following protocols: BACnet MS/TP. The following BACnet points shall be available for viewing at the BAS system:

    a. Supply fan array total airflow, pressure rise, average temperature, density, average speed.
    b. Return fan array total airflow, pressure rise, average temperature, density, average speed.
    c. Relay 1 status – power
    d. Relay 2 status – fan failure
    e. Relay 3 status – warning

G. FAN SPEED CONTROL

1. Each variable air volume supply and return fan array shall be provided with an individual variable frequency drive as specified under another specification section.

H. Accessories
1. Companion Flanges: Galvanized steel, for duct connections.
2. Inlet Screens: Galvanized steel welded grid screen.
3. Protective Cage (for Plenum Fan only): Galvanized steel welded grid screen
4. Flexible Connection: Glass fabric double coated with neoprene.with minimum tensile strength of 480lbf/inch in the wrap and 360 lbf/inch in the filling, capable of withstanding up to 12” W.G. static pressure. Service temperature: minus 40 to 200 deg F

I. Vibration Isolation Base:

1. Select isolation devices for uniform static deflections according to distribution of weight. Minimum isolation efficiency shall be 90 - 95%. The minimum mounting deflection of spring isolators shall be as follows:

Operating Speed (RPM)	Min. Deflection (Inches)
300	3.50
500	2.00
800 and higher	1.00

J. Thrust restraints shall be designed to restrain the fan during start-up loads. Provide spring isolation with 1” deflection to prevent short-circuiting of the fan vibration to air handling unit.

2.12 FILTERS:

A. Filters:

1. Prefilters shall be 2” thick, high efficiency, pleated, disposable type. Each filter shall consist of glass fiber media, media support grid and enclosing frame. The filter shall be listed by Underwriters’ Laboratories as Class II. Filter sizes shall be limited to two sizes, 12”x24”x2” or 24”x24”x2” as specified on the drawings.

2. Medium efficiency pleated filters shall be 2” thick MERV 10 as rated by ASHRAE Standard 52.1 test methods. Filter media shall be of the non woven cotton fabric type. Filters shall be UL900 Class 2 listed
3. The enclosing frame shall be constructed of a rigid, heavy duty, high wet strength beverage board, with diagonal support members bonded to the air entering and air exit side of each pleat.

2.13 FILTER FRAMING SYSTEMS:

A. 16-gauge minimum galvanized steel framing members with access for upstream (front) filter servicing, cut to size and pre-punched for assembly into modules. Equip framing systems with gaskets, fasteners and filter centering dimples.

B. Filter fasteners shall be capable of being installed without tools, nuts, or bolts.

C. Vertically support the filters to prevent deflection of horizontal members without interfering with either filter installation or operation.

D. The entire enclosing frame assembly shall be caulked and then riveted or welded together such that the caulk presses out of the frame.

E. The entire filter frame system shall be composed of either 24”x24”, 24”xl2” or l2”x24” individual modular holding frames.

2.14 AIR PRESSURE GAUGES:

A. Air Pressure Gauges: Furnish and install diaphragm actuated dial type differential pressure gauges complete with integral tips and valves, Magnehelic Series 2000 or equal. Accuracy shall be ±2% of full scale.

B. Ranges shall be as follows:

1. 0 to 1.0" of water for pre-filters
2. 0 to 4.0" of water for final filters
3. 0 to 5.0" of water for low pressure fans
4. 0 to 15.0" of water for high pressure fans

C. Provide thermometers where indicated in the H.V.A.C. Flow Diagram on the drawings.

D. Provide air pressure gauges at the following locations.

1. Each filter location on air handling system.
2. Each supply and return fan.

2.15 AIR THERMOMETERS:

A. Air thermometers shall be the adjustable angle bimetallic 5-1/2" dial type with stainless steel case (± 1/4% accuracy). Dial shall be the anti-parallel type with black figures and pointer.

B. Provide recalibration screw in the case for pointer adjustment. Provide duct flange for mounting and stem length of 8" minimum.

C. Temperature range shall be follows.

1. 0 to 120°F upstream of cooling coils.
2. -10 to 110°F upstream of energy recovery coils.
3. -10 to 110°F upstream of preheat coils.
4. 0 to 80°F downstream of cooling coils.
5. 0 to 80°F in unit discharge plenums.

D. Calibrate thermometers in ice water before installation.

E. Provide air thermometers where indicated on the H.V.A.C. Flow Diagram on the drawings.

F. Provide air thermometers at the following locations:

1. All supply air from air handling units.
2. All outside air to air handling units.
3. In mixed air plenum of each air handling unit.
4. At discharge and entrance of each cooling and/or heat coil.
5. At each duct thermostat or sensor if not located at one of the above.

G. Pneumatic transmission type thermometers are not acceptable.

2.16 PLENUMS:

A. All plenum sections of the air handling unit shall be pre-cut to the exact locations of the duct connections as shown on the drawings. Provide bell-mouth fittings at the discharge duct connections. The bell mouth fitting shall protrude through and mount flush with the interior skin of the plenum section.

2.17 MOTORS

A. Motor shall be NEMA Design B squirrel cage induction type designed for across-the-line starting.

B. Provide totally enclosed motors with cast-iron frames.

C. Constant speed motors shall be the premium energy efficient design of the motor manufacturer.

D. Torque Characteristics: Sufficient to accelerate driven loads satisfactorily. Temperature Rating: 50 deg C maximum temperature rise at 40 deg C ambient for continuous duty at full load (Class A Insulation).

E. Service Factor: 1.15 for polyphase motors.

F. Bearings: Motors shall have grease lubricated ball bearings designed to deliver a minimum L10 life of 250,000 hours at full load and the maximum operating RPM of the associated fan. Grease zerks and spring-loaded grease relief valves shall be provided in each motor to allow easy bearing lubrication without damaging the seals due to over lubrication. Permanently lubricated bearings are allowed if a spare motor per fan array is provided.

G. Motors for Division I locations shall have a T3C temperature code.

H. For efficient operation in a direct drive application, motors shall be capable of operating greater than 60HZ to at least the design operating speed of the fan.

I. Motors shall be factory wired to a motor control center for connection to a VFD. The motor control center shall include for each motor circuit a control device providing overload protection, short circuit protection and a manual disconnect means, and all circuits shall be wired to a common main panel terminal block. Each control device shall include an auxiliary output capable of providing remote notification of a motor failure. All motors shall operate at all times and be controlled in unison, maintaining a consistent and uniform airflow pattern over coils, filters and other devices.

J. Nameplate: Indicate full identification of manufacturer, ratings, characteristics, construction, and special features.

K. Motors Used With Variable Frequency Drives

1. Motors shall be totally enclosed, fan cooled, inverter-duty motors. Inverter-ready and inverter-rated motors are not acceptable.
2. Ratings, characteristics, and features shall be coordinated with and approved by the variable frequency drive manufacturer. Motors shall not be limited to use with the same manufacturer's variable frequency drives.
3. Motors shall be designed with critical vibration frequencies outside operating range of controller output.
4. Motors shall comply with all of NEMA MG1, Part 31 "Definite Purpose Inverter-fed Motors."
5. Motor Frames shall be cast iron construction.
6. Motor insulation systems shall consist of Class H or higher rated materials.
7. Temperature Rise: Matched to rating for Class B insulation.
8. Each motor shall be provided with a shaft grounding device to harmlessly bleed potential induced shaft voltages to ground.

2.18 ELECTRICAL / LIGHTS

A. In each section, provide a minimum of two 2-32 Watt (LED equivalent) lamps vapor-proof weather-tight LED, 4-ft. light fixtures with a low-temperature electronic ballast with less than 10% total harmonic distortion.

B. At each access entry and on the exterior skin of the unit, provide a SPDT pilot light switch wired to the light fixture through a sealed rigid steel conduit. All lights shall be wired in accordance to the National Electric Code.

C. Power to all the lights shall be wired back to a single point connection (junction box) external to the unit.

D. Air handling units are wet environments. Power and control wiring within air handling units shall be in rigid steel conduit and sealed airtight. Junction boxes and enclosures within air handling units shall be threaded cast aluminum with gasketed plate covers. Air handling unit conduit penetrations shall be sealed airtight. Controls (including valve and damper motors) inside air handling units shall be weatherproof.

E. Provide one 120 volt, weather-tight, GFI duplex electrical receptacle at each fan and filter section plus other locations as detailed on the drawings. Wire receptacle to same single point connection (junction box) external to the unit as the lights.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive units for compliance with requirements for installation tolerances and other conditions affecting unit performance. Examine proposed route of moving units into place and verify that it is free of interferences. Verify piping rough-in locations. Verify branch circuit wiring suitability. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Final locations of the units on the Drawings are approximate, unless dimensioned. Determine exact locations before roughing-in piping and electrical work.

3.2 INSTALLATION, GENERAL

A. General: Provide the labor, materials and equipment necessary to lift custom air handling units and set them in place, and assemble the unit sections in the locations shown on the drawings.

B. Anchor units to concrete pads in accordance with manufacturer's instructions and contract documents.

C. Units will be delivered to the project site in several sections. Maximum weight of each section will be 20,000#. Assemble unit sections in the locations shown on the drawings. Make any required connections between sections such as, fastening sections together, connecting piping and wiring, etc.

D. Install custom air-handling units level and plumb, according to manufacturer's written instructions.

1. Support floor-mounted units on concrete pads. Secure units to anchor bolts installed in concrete pad. Concrete pads must be dead level.

E. Arrange installation of units to provide access space around air-handling units for service and maintenance.

F. Some units will be built around structural members. Provide sheet metal and insulation between sections and seal airtight.

3.3 CONNECTIONS

A. The Drawings indicate the general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

1. Arrange piping installations to allow unit servicing and maintenance.
2. Connect condensate drain pans using Type L copper tubing. Provide piping full size of unit drain outlets. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.
3. Chilled Water and Energy Recovery Water Piping: Conform to applicable requirements of Division 23 sections. Connect to supply and return coil tappings as indicated.
4. Steam and Condensate Return Piping: Conform to applicable requirements of Division 23 sections. Connect to supply and return coil tappings as indicated. Field piping will be required inside the custom units for condensate return piping.

B. The Drawings indicate the general arrangement of ducts and duct accessories. Make final duct connections as indicated.

C. Electrical: Conform to applicable requirements of Division 16 Sections.

D. Connect fan motors to wiring systems and to ground. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD PRESSURE TESTING

A. Pressure test units after sections have been assembled and before pipe and duct connections are made. 2-1/2% leakage is allowed. All controls, electric and piping penetrations must be in place before test.

1. Test pressure shall be 6 inches for the high pressure sections (supply fan discharge section and sections downstream.
2. Test pressure shall be 4 inches for the other unit sections.

3.5 ADJUSTING

A. Adjust water coil flow, with control valves to full coil flow, to indicated gpm.

B. Adjust damper linkages for proper damper operation.

3.6 CLEANING

A. After completing installation, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.

B. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.

3.7 STARTUP

A. Manufacturer's Field Inspection: The owner has engaged a factory-authorized service representative to perform the following:
1. Inspect field assembly of components and installation of central-station air-handling units including piping, ductwork, and electrical connections.
2. Prepare a written report on findings and recommended corrective actions.

B. Final Checks before Startup: Perform the following before startup:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections for piping, ductwork, and electrical are complete. Verify that proper thermal overload protection is installed in motors, starters, and disconnects.
3. Perform cleaning and adjusting specified in this Section.
4. Verify proper motor rotation direction and verify free fan wheel rotation and smooth bearings operations.
5. Lubricate bearings and other moving parts with factory-recommended lubricants.
6. Comb coil fins for parallel orientation.
7. Verify that manual and automatic volume control, and smoke dampers in connected ductwork systems are in fully open position.

C. Starting procedures for custom air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel.
2. Measure and record motor electrical values for voltage and amperage.

3.8 DEMONSTRATION

A. Demonstration Services: Arrange and pay for a factory-authorized service representative to train Owner's maintenance personnel on the following:

1. Procedures and schedules related to start-up and shut down, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
2. Review operating and maintenance data contained in the Operating and Maintenance Manuals.

B. Schedule training with at least 7 days' advance notice.

END OF SECTION 237323

SECTION 238216.11 - HYDRONIC AIR COILS

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. Hydronic air coils.

B. Related Requirements:

1. Section 238216.12 "Steam Air Coils" for air coils using steam as the heating medium.

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 each air coil.
2. Include rated capacities, operating characteristics, and pressure drops for each air coil.

B. Sustainable Design Submittals:

1. Product data showing compliance with ASHRAE 62.1.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air coils to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. ASHRAE 62.1 Compliance: Comply with applicable requirements in ASHRAE 62.1, Section 5, "Systems and Equipment," and Section 7, "Construction and Startup."

B. Performance Ratings: Tested and rated in accordance with AHRI 410 and ASHRAE 33.

C. Minimum Working-Pressure/Temperature Ratings: 200 psig (1380 kPa)/300 deg F (149 deg C).

D. Select cooling coils for no moisture carryover at design conditions. Provide moisture eliminators on discharge face of cooling coil if necessary to eliminate moisture carryover.

2.2 HYDRONIC AIR COILS

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. Daikin.
2. Greenheck Fan Corporation.
3. USA Coil & Air.

B. Source Limitations: Obtain hydronic coils from single source from single manufacturer.

C. Description: Coils constructed of staggered tubes mechanically expanded into continuous collars that are die-formed into the coil fins; self-venting; counterflow design of air to fluid.

D. Tubes:

1. Material: Copper.
2. Nominal Diameter: Minimum 5/8 inch (16 mm) before expanding, selected to provide performance indicated.
3. Nominal Wall Thickness: As required by performance, minimum 0.035 inch (0.889 mm) thick.
4. Return Bends: 180-degree bends; material, wall thickness, and nominal diameter to match tubes.

E. Fins:

1. Type: Plate.
2. Materials:

    a. Aluminum: 0.01 inch thick.
3. Collars: Full collars for accurate fin spacing and maximum tube contact while leaving no surface of tube exposed.
4. Fin and Tube Joint: Mechanical bond.

F. Headers:

1. Material: Copper.
2. Tube-to-Header Connections: Tube-to-header holes to intrude inward, so landed surface area is 3 times the core tube thickness, to provide enhanced-header-to-tube joint integrity. Evenly extend tubes within the ID of the header no more than 0.12 inch (3 mm).
3. Header Top and Bottom Caps: End caps to be die-formed and installed on the ID of header, such that the landed surface area is 3 times the header wall thickness.
4. Drains: Include low point of supply and return header with a NPS 1/2 (DN 13) drain connection.
5. Vents: Include high point of supply and return header with a NPS 1/2 (DN 13) vent connection.
6. Supply and Return Connections: Copper pipe; threaded or flanged, same end of coil.
7. Protect opening of supply, return, vent, and drain connections with a threaded cap to prevent entry of dirt into coil.

G. Casings and Tube Sheets:

1. Depth: Extend coil casing and tube sheets a minimum of 1/2 inch (13 mm) beyond face of fins on both entering and leaving sides.
2. Materials:

a. Cooling Coil: Stainless steel, Type 304, No. 2D finish, ASTM A240/A240M.
b. Heating Coil: Galvanized steel, ASTM A653/A653M, G90 (Z275) coating.

H. End Tube Sheets:

1. Tube sheet holes rolled to prevent chaffing of tubes during thermal expansion and contraction.
2. Flange face minimum of 1-1/2 inches (68 mm).
3. Thickness: Minimum of 16 gauge (1.6 mm) thick.

I. Intermediate Tube Sheets:

1. Tube sheet holes rolled to prevent chaffing of tubes during thermal expansion and contraction.
2. Space intermediate tube sheets a maximum of 48 inches (1200 mm) o.c. and locate to provide equal spacing between tube sheet across coil tube length.
3. Flange face minimum of 1/2 inch (13 mm).
4. Thickness: Minimum of 16 gauge (1.6 mm) thick.

J. Holes: Include number, size, and location of holes in casing and end tube sheets required for coil installation.

K. Hardware: Use hex-head bolts, nuts, and washers constructed of Type 304 stainless steel.

L. Nameplate: Aluminum or stainless steel nameplate with brass or stainless steel chain for each coil, with the following data engraved or embossed:

1. Manufacturer name, address, telephone number, and website address.
2. Manufacturer model number.
3. Serial number.
4. Manufacturing date.
5. Coil identification (indicated on Drawings).
6. Coil fin length.
7. Coil fin height.
8. Coil weight with fluid/without fluid.
9. Coil casing material and thickness.
10. Coil fin material and thickness.
11. Coil tube material and thickness.
12. Coil header material and thickness.

2.3 MATERIALS

A. Aluminum: ASTM B209 (ASTM B209M).

B. Copper Tube: ASTM B75/ASTM 75M annealed temper or ASTM B280 drawn temper.

C. Copper Sheet: ASTM B152.

D. 90/10 Cupronickel Alloy: ASTM B122/ASTM B122M.

E. Steel:

1. Pipe Connections: ASTM A53/A53M.

2.4 SOURCE QUALITY CONTROL

A. Hydronic Coils: Factory tested with air while coil is completely submerged underwater to design pressure indicated, but not less than 300-psig (2070-kPa) internal pressure.

B. Coils to display a tag with inspector's identification as proof of testing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine ducts, plenums, and casings to receive air coils for compliance with requirements for installation tolerances and other conditions affecting coil performance.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before coil installation.

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

3.2 INSTALLATION

A. Install coils level and plumb.

B. Install coils in metal ducts and casings constructed in accordance with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."

C. Install stainless steel drain pan under each cooling coil.

1. Construct drain pans with connection for drain; insulated and complying with ASHRAE 62.1.
2. Construct drain pans to extend beyond coil length and width and to connect to condensate trap and drainage.
3. Extend drain pan upstream and downstream from coil face.
4. Extend drain pan under coil headers and exposed supply piping.

D. Install moisture eliminators for cooling coils. Extend drain pan under moisture eliminator.

E. Straighten bent fins on air coils.

F. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.

3.3 PIPING CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to coils to allow service and maintenance.

C. Connect water piping with unions and shutoff valves to allow coils to be disconnected without draining piping. Control valves are specified in Section 230923.11 "Control Valves," and other piping specialties are specified in Section 232116 "Hydronic Piping Specialties."

END OF SECTION 238216.11

SECTION 238216.12 - STEAM AIR COILS

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. Steam air coils.

B. Related Requirements:

1. Section 238216.11 "Hydronic Air Coils" for air coils using water as the heating or cooling medium.

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 each air coil.
2. Include rated capacities, operating characteristics, and pressure drops for each air coil.

B. Sustainable Design Submittals:

1. Product data showing compliance with ASHRAE 62.1.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air coils to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. ASHRAE 62.1 Compliance: Comply with applicable requirements in ASHRAE 62.1, Section 5, "Systems and Equipment," and Section 7, "Construction and Startup."

B. Performance Ratings: Tested and rated in accordance with AHRI 410 and ASHRAE 33.

C. Minimum Working-Pressure/Temperature Ratings: 100 psig (690 kPa)/400 deg F (204 deg C).

2.2 STEAM AIR COILS

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. Daikin
2. Greenheck Fan Corporation.
3. USA Coil & Air.

B. Source Limitations: Obtain steam air coils from single source from single manufacturer.

C. Description: Plate fin coils constructed of tubes mechanically expanded into continuous collars that are die-formed into plate fins and specially designed for thermal expansion and contraction of the tubes during coil operation.

1. Distributing-type steam coils of a tube-in-tube design for uniform steam distribution along the entire length of each tube, to ensure a consistent temperature rise across the full coil face and accelerate condensate removal.

D. Tubes:

1. Material: Copper.
2. Nominal Diameter: Minimum 1 inch (25 mm) before expanding, selected to provide performance indicated.
3. Nominal Wall Thickness: As required by performance, minimum of 0.035 inch (0.889 mm) thick.
4. Features: Individually drainable.

E. Fins:

1. Type: Plate.
2. Materials:

   a. Aluminum: 0.01 inch thick.
3. Collars: Full collars for accurate fin spacing and maximum tube contact while leaving no surface of tube exposed.
4. Fin and Tube Joint: Mechanical bond.

F. Headers:

1. Material: Carbon steel, removable for cleaning and inspection of tubes.
2. Tube-to-Header Connections: Tube-to-header holes to intrude inward, so landed surface area is 3 times the core tube thickness, to provide enhanced header-to-tube joint integrity. Evenly extend tubes within the ID of the header no more than 0.12 inch (3 mm).
3. Header Top and Bottom Caps: End caps to be die-formed and installed on the ID of header, such that the landed surface area is 3 times the header wall thickness.
4. Drains: Include low point of supply and return header with a NPS 1/2 (DN 13) drain connection.
5. Vents: Include high point of supply and return header with a NPS 1/2 (DN 13) vent connection.
6. Supply and Condensate Return Connections: Copper pipe; threaded or flanged, same end of coil.
7. Protect opening of supply, return, vent, and drain connections with a threaded cap to prevent entry of dirt into coil.

G. Casings and Tube Sheets:

1. Depth: Extend coil casing and tube sheets a minimum of 1/2 inch (13 mm) beyond face of fins on both entering and leaving sides.

2. Materials:
   a. Galvanized steel, G90 (Z275) coating.

H. Top and Bottom Casings:

1. Flange face minimum of 1-1/2 inches (68 mm); double-flange edge for rigidity and ease of removal with secondary flange face minimum of 1/2 inch (13 mm).
2. Thickness:

   a. Coils with Fin Length of Up to 72 Inches (1800 mm): Minimum of 16 gauge (1.6 mm) thick.
   b. Coils with Fin Length Exceeding 72 Inches (1800 mm): Minimum of 16 gauge (1.6 mm) thick.

I. End Tube Sheets:

1. Tube sheet holes rolled to prevent chaffing of tubes during thermal expansion and contraction.
2. Flange face minimum of 1-1/2 inches (68 mm).
3. Thickness: Minimum of 16 gauge (1.6 mm) thick.

J. Intermediate Tube Sheets:

1. Tube sheet holes rolled to prevent chaffing of tubes during thermal expansion and contraction.
2. Space intermediate tube sheets a maximum of 48 inches (1200 mm) o.c. and locate to provide equal spacing between tube sheet across coil tube length.
3. Flange face minimum of 1/2 inch (13 mm).
4. Thickness: Minimum of 16 gauge (1.6 mm) thick.

K. Holes: Include number, size, and location of holes in casing and end tube sheets required for coil installation.

L. Hardware: Use hex-head bolts, nuts, and washers constructed of Type 304 stainless steel.

M. Nameplate: Aluminum or stainless steel nameplate with brass or stainless steel chain for each coil, with the following data engraved or embossed:

1. Manufacturer name, address, telephone number, and website address.
2. Manufacturer model number.
3. Serial number.
4. Manufacturing date.
5. Coil identification (indicated on Drawings).
6. Coil fin length.
7. Coil fin height.
8. Coil weight with fluid/without fluid.
9. Coil casing material and thickness.
10. Coil fin material and thickness.
11. Coil tube material and thickness.
12. Coil header material and thickness.

2.3 MATERIALS

A. Aluminum: ASTM B209 (ASTM B209M).

B. Copper Tube: ASTM B75/B75M annealed temper or ASTM B280 drawn temper.

C. Copper Sheet: ASTM B152.

D. Galvanized Steel: ASTM A653/A653M.

E. 90/10 Cupronickel Alloy: ASTM B122/B122M.

F. Stainless Steel: ASTM A240/A240M.

G. Steel:

1. Pipe Connections: ASTM A53/A53M.

2.4 SOURCE QUALITY CONTROL

A. Steam Coils: Factory tested to 300 psig (2070 kPa).

B. Coils to display a tag with inspector's identification as proof of testing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine ducts, plenums, and casings to receive air coils for compliance with requirements for installation tolerances and other conditions affecting coil performance.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before coil installation.

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

3.2 INSTALLATION

A. Install coils level and plumb.

B. Install coils in metal ducts and casings constructed in accordance with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."

C. Straighten bent fins on air coils.

D. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.

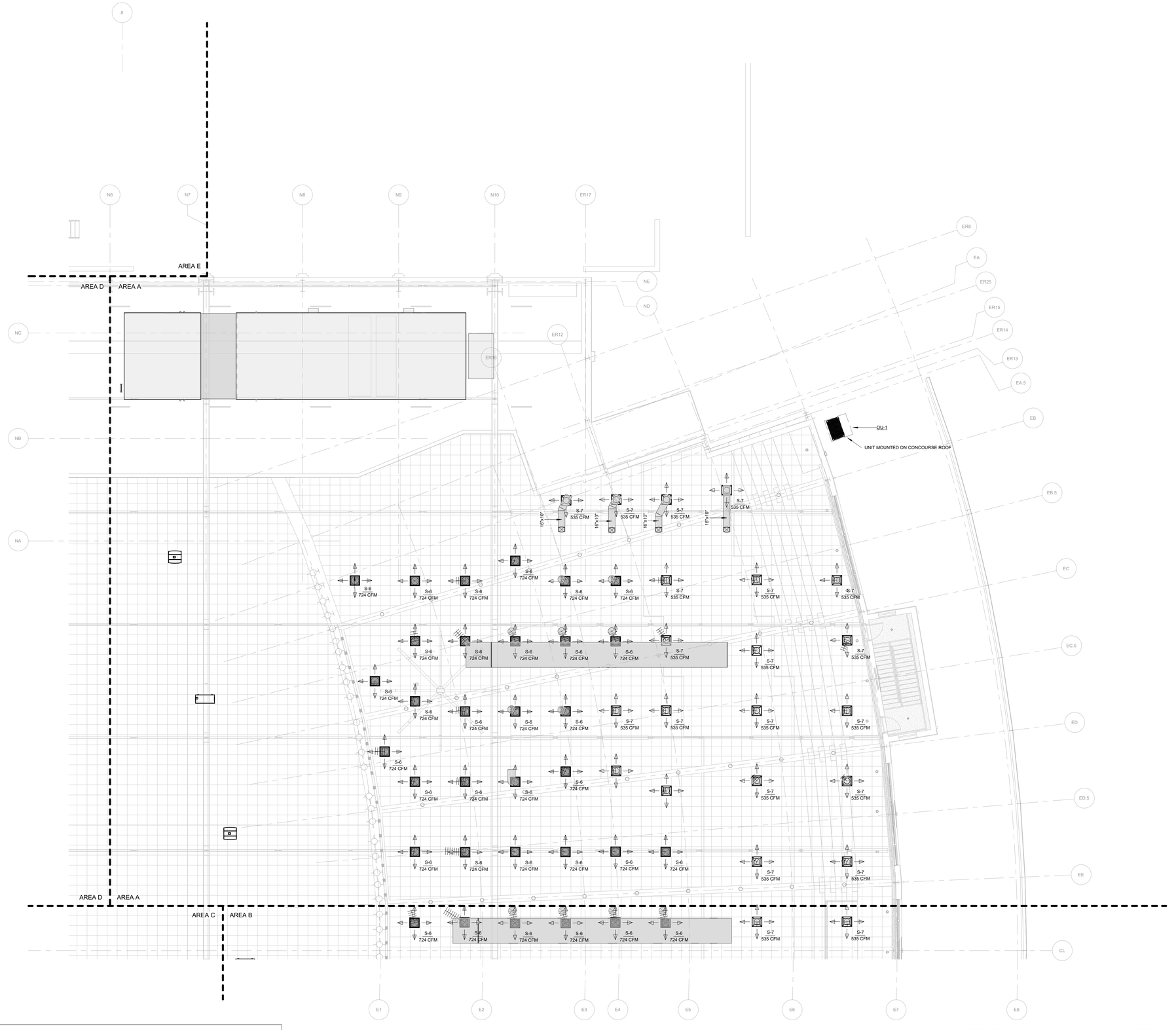
3.3 PIPING CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to coils to allow service and maintenance.

C. Connect steam piping with gate valve and union and steam condensate piping with union, strainer, trap, and gate valve to allow coils to be disconnected without draining piping. Control valves are specified in Section 230923.11 "Control Valves," and other piping specialties are specified in Section 232213 "Steam and Condensate Heating Piping."

END OF SECTION 238216.12



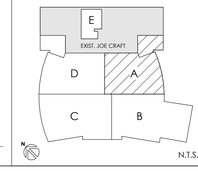
UPPER LEVEL HVAC PLAN - AREA A

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

NOTE:

IT IS NOT INTENDED THAT THE PLANS SHOW ALL OFFSETS IN PIPES, CONDUITS, AND DUCTS REQUIRED FOR INSTALLATION OF THE WORK. DETAILS AND SECTIONS ARE INCLUDED FOR SOME AREAS TO SHOW INTENDED RELATIONSHIP OF THE WORK OF VARIOUS TRADES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND SUB-CONTRACTORS TO COORDINATE INSTALLATION OF THE WORK AND TO PROVIDE THE NECESSARY OFFSETS, TRANSFORMATIONS, AND FITTINGS REQUIRED. NO ADDITIONAL COMPENSATION WILL BE ALLOWED FOR CORRECTION CONFLICTS BETWEEN THE WORK OF VARIOUS TRADES. DETAILS AND SECTIONS ARE SHOWN FOR THE CONTRACTORS CONVENIENCEAND SHALL NOT BE CONSIDERED COMPLETE IN EVERY DETAIL.

KEY PLAN



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HNTB
HNTB Corporation
715 Kirk Drive
Kansas City, Missouri 64105
p. 816.472.1201

STAGGS & FISHER CONSULTING ENGINEERS, INC.
3064 Lochness Drive
Lexington KY 40517
859-271-3246

NOT FOR CONSTRUCTION

UPPER LEVEL HVAC PLAN - AREA A

IMPROVE MEMORIAL COLISEUM
FOR:
THE UNIVERSITY OF KENTUCKY
LEXINGTON, KENTUCKY

Architect of Record:
Civil Engineer:
Landscape Architect:
RossTarrant Architects, Inc.
101 Old Lafayette Avenue
Lexington, Kentucky 40502
p 859.254.4018

Signature Sports Architect:
HNTB Corporation
715 Kirk Drive
Kansas City, Missouri 64105
p 816.472.1201

Structural Engineer of Record:
Brown + Kubican, PSC
2224 Young Drive
Lexington, Kentucky 40505
p 859.543.0933

MEP Engineer:
Staggs & Fisher Consulting Engineer
3264 Lochness Drive
Lexington, Kentucky 40517
p 859.271.3246

UK# 2520.0

Project No: 1924
Drawn By: AL
Rev'd By: CK

ISSUED FOR:

REVISIONS

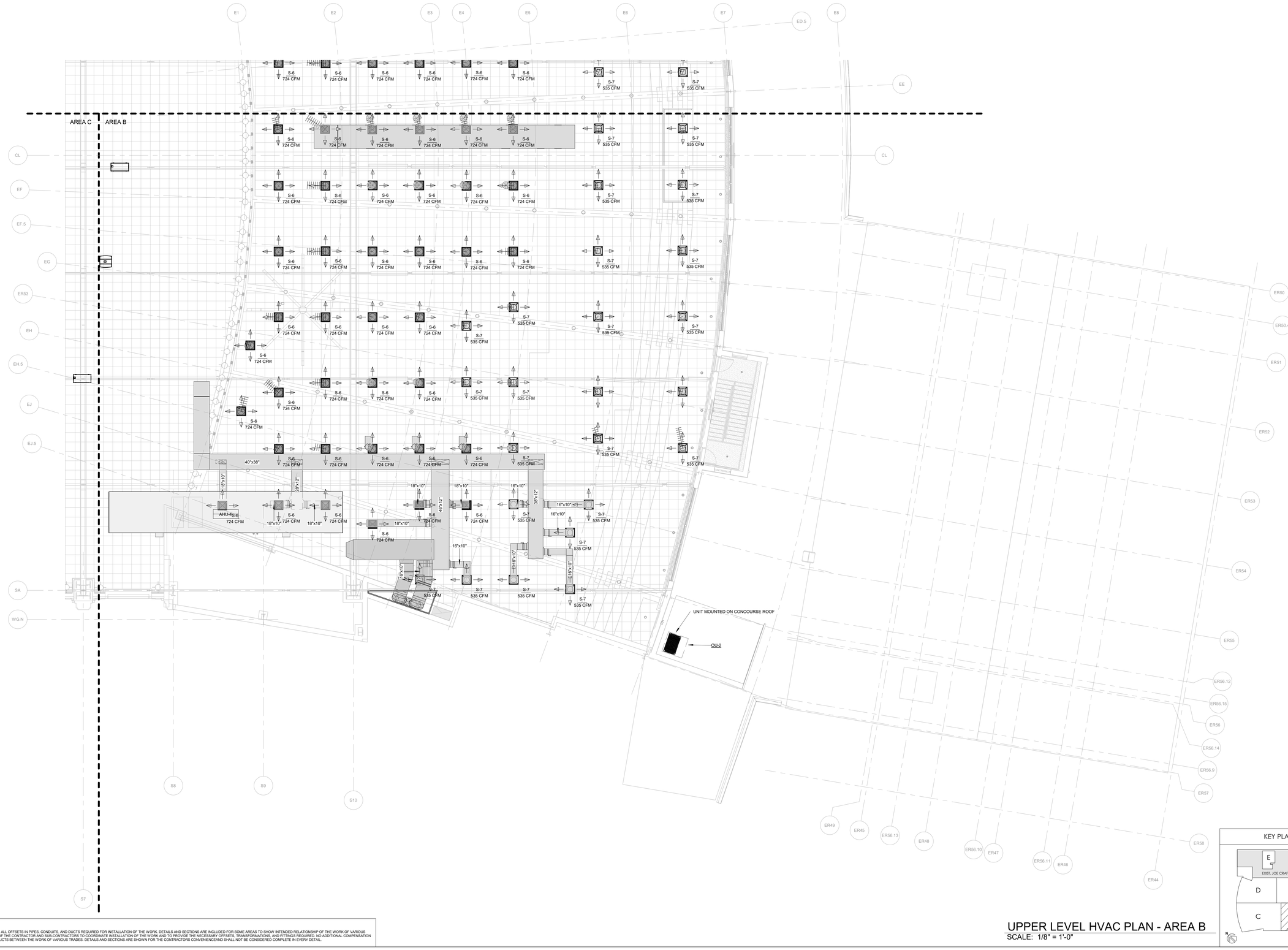
#	DATE	DESCRIPTION

CONSTRUCTION DOCUMENTS

H230A

UPPER LEVEL HVAC PLAN - AREA A

DATE ISSUED:
MARCH 26, 2021



NOTE:

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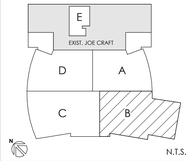
UPPER LEVEL HVAC PLAN - AREA B

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

KEY PLAN



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Lexington KY 40517
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UPPER LEVEL HVAC PLAN - AREA B

IMPROVE MEMORIAL COLISEUM
FOR:
THE UNIVERSITY OF KENTUCKY
LEXINGTON, KENTUCKY

Architect of Record:
Civil Engineer:
Landscape Architect:
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UK# 2520.0

Project No: 1924
Drawn By: AL
Rev'd By: CK

ISSUED FOR:

REVISIONS

#	DATE	DESCRIPTION

CONSTRUCTION DOCUMENTS

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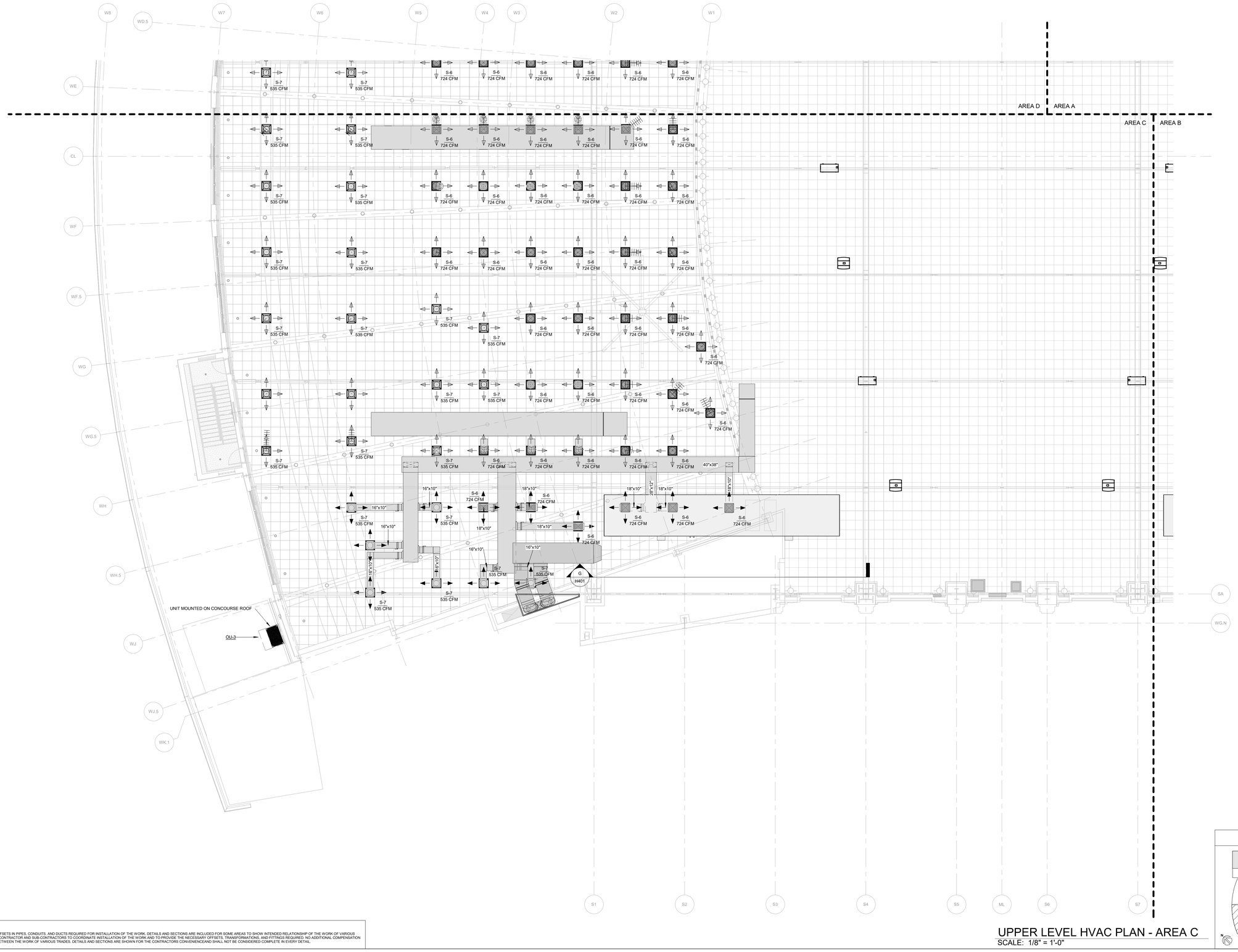
UPPER LEVEL HVAC PLAN - AREA B

DATE ISSUED:
MARCH 26, 2021



UPPER LEVEL HVAC PLAN - AREA C

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

NOTE:

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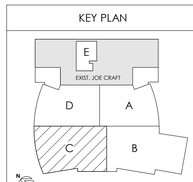
KEY PLAN



N.T.S.

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UPPER LEVEL HVAC PLAN - AREA C

IMPROVE MEMORIAL COLISEUM

FOR:

THE UNIVERSITY OF KENTUCKY

LEXINGTON, KENTUCKY

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UK# 2520.0

Project No: 1924
Drawn By: AL
Rev'd By: CK

ISSUED FOR:

REVISIONS

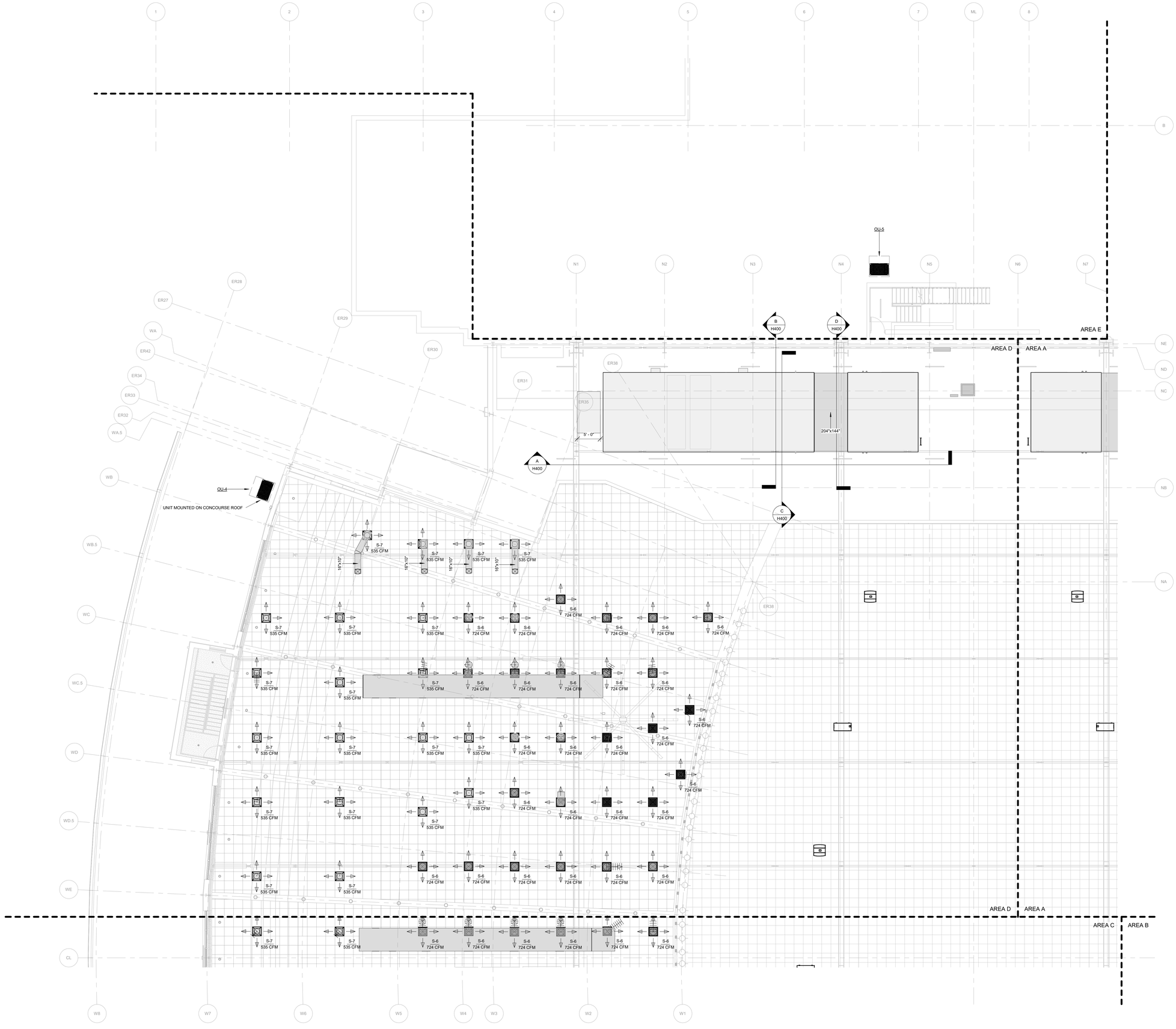
#	DATE	DESCRIPTION

CONSTRUCTION DOCUMENTS

H230C

UPPER LEVEL HVAC PLAN - AREA C

DATE ISSUED:
MARCH 26, 2021



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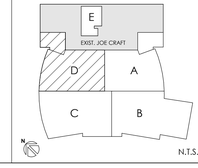
UPPER LEVEL HVAC PLAN - AREA D

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

KEY PLAN



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UPPER LEVEL HVAC PLAN - AREA D

IMPROVE MEMORIAL COLISEUM

FOR:

THE UNIVERSITY OF KENTUCKY

LEXINGTON, KENTUCKY

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UK# 2520.0

Project No: 1924
Drawn By: AL
Rev'd By: CK

ISSUED FOR:

REVISIONS

#	DATE	DESCRIPTION

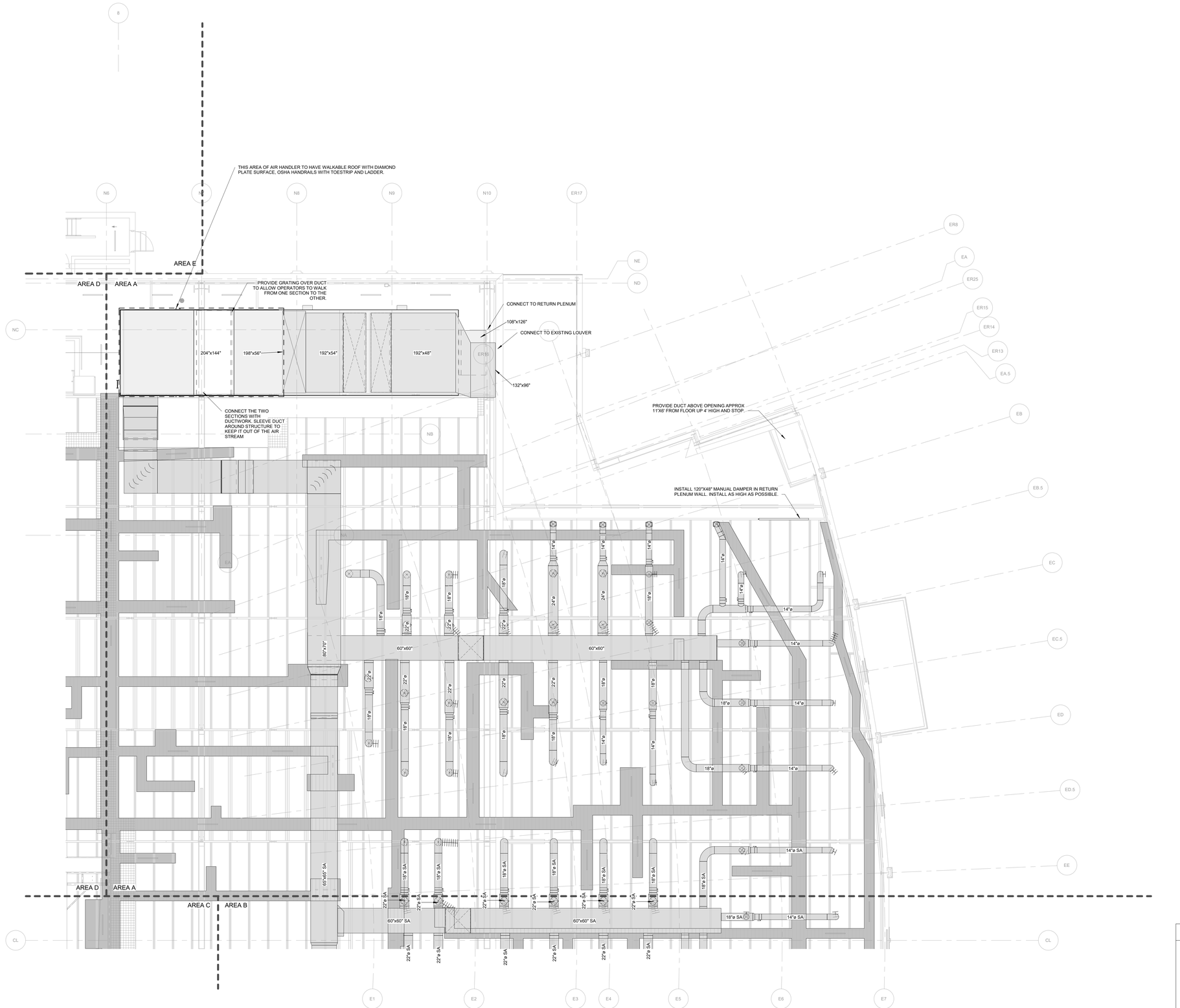
CONSTRUCTION DOCUMENTS

H230D

UPPER LEVEL HVAC PLAN - AREA D

DATE ISSUED:
MARCH 26, 2021

ROOM SCHEDULE: ATTIC	
ROOM NUMBER	ROOM NAME
A300A	ATTIC
D300A	ATTIC MEZZ.



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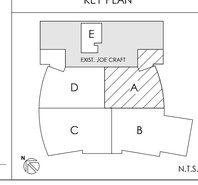
ATTIC LEVEL HVAC PLAN - AREA A

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

KEY PLAN



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ATTIC LEVEL HVAC PLAN - AREA A

IMPROVE MEMORIAL COLISEUM
FOR:
THE UNIVERSITY OF KENTUCKY
LEXINGTON, KENTUCKY

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UK# 2520.0

Project No: 1924
Drawn By: AL
Rev'd By: CK

ISSUED FOR:

REVISIONS

#	DATE	DESCRIPTION

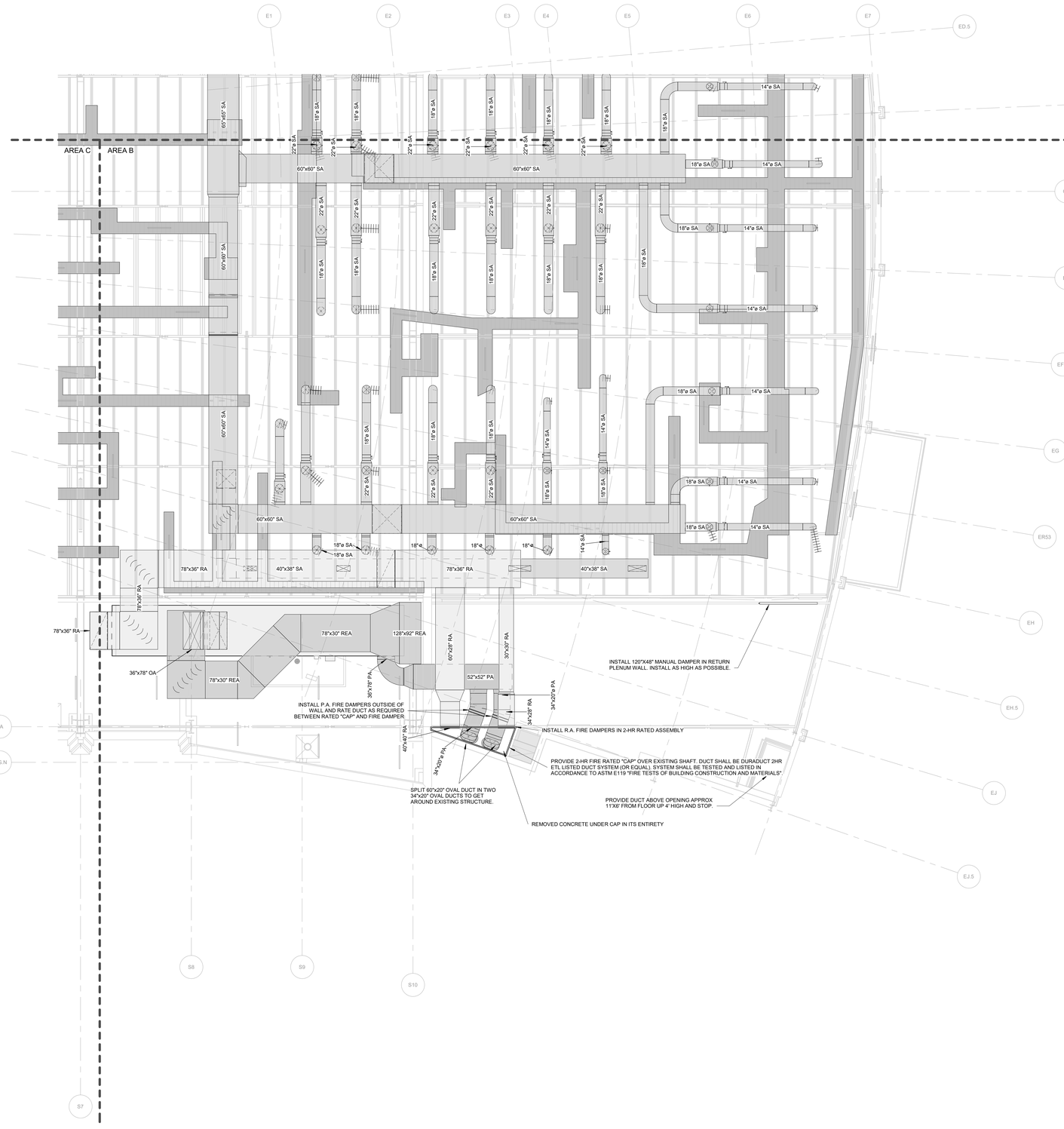
CONSTRUCTION DOCUMENTS

H240A

ATTIC LEVEL HVAC PLAN - AREA A

DATE ISSUED:
MARCH 26, 2021

ROOM SCHEDULE: ATTIC	
ROOM NUMBER	ROOM NAME
A300A	ATTIC
D300A	ATTIC MEZZ.



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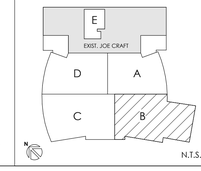
ATTIC LEVEL HVAC PLAN - AREA B

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

KEY PLAN



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ATTIC LEVEL HVAC PLAN - AREA B

IMPROVE MEMORIAL COLISEUM
FOR:
THE UNIVERSITY OF KENTUCKY
LEXINGTON, KENTUCKY

Architect of Record:
Civil Engineer:
Landscape Architect:
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Signature Sports Architect:
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Structural Engineer of Record:
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p 859.543.0933

MEP Engineer:
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p 859.271.3246

UK#: 2520.0
Project No: 1924
Drawn By: AL
Rev'd By: CK

ISSUED FOR:

REVISIONS

#	DATE	DESCRIPTION

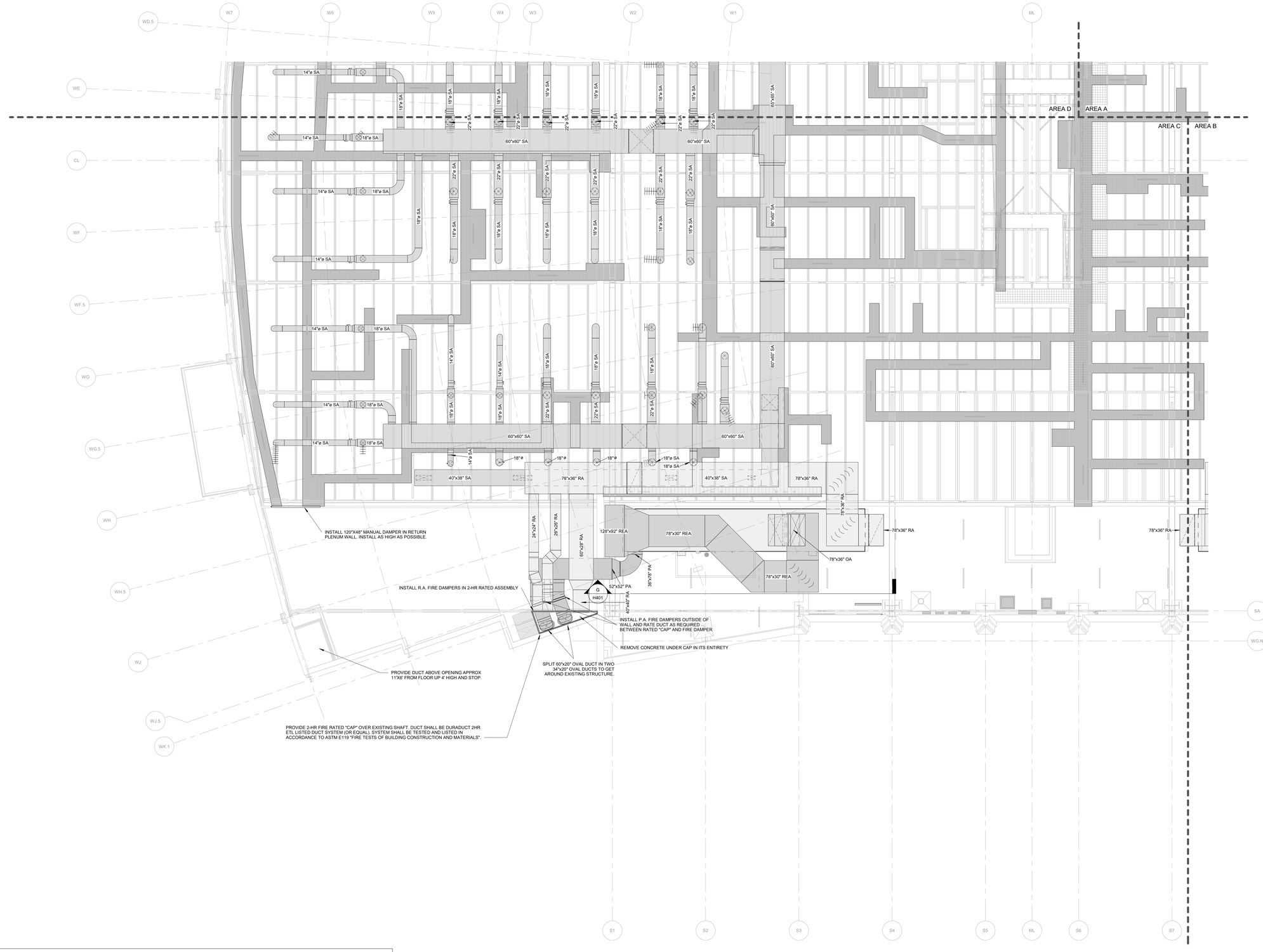
CONSTRUCTION DOCUMENTS

H240B

ATTIC LEVEL HVAC PLAN - AREA B

DATE ISSUED:
MARCH 26, 2021

ROOM SCHEDULE: ATTIC	
ROOM NUMBER	ROOM NAME
A300A	ATTIC
D300A	ATTIC MEZZ.



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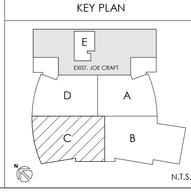
ATTIC LEVEL HVAC PLAN - AREA C

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

KEY PLAN



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Lexington, KY 40517
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NOT FOR CONSTRUCTION

ATTIC LEVEL HVAC PLAN - AREA C

IMPROVE MEMORIAL COLISEUM
FOR:
THE UNIVERSITY OF KENTUCKY
LEXINGTON, KENTUCKY

Architect of Record:
Civil Engineer:
Landscape Architect:
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Signature Sports Architect:
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p 859.543.0933

MEP Engineer:
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3264 Lochness Drive
Lexington, Kentucky 40517
p 859.271.3246

UK#: 2520.0

Project No: 1924
Drawn By: AL
Rev'd By: CK

ISSUED FOR:

REVISIONS

#	DATE	DESCRIPTION

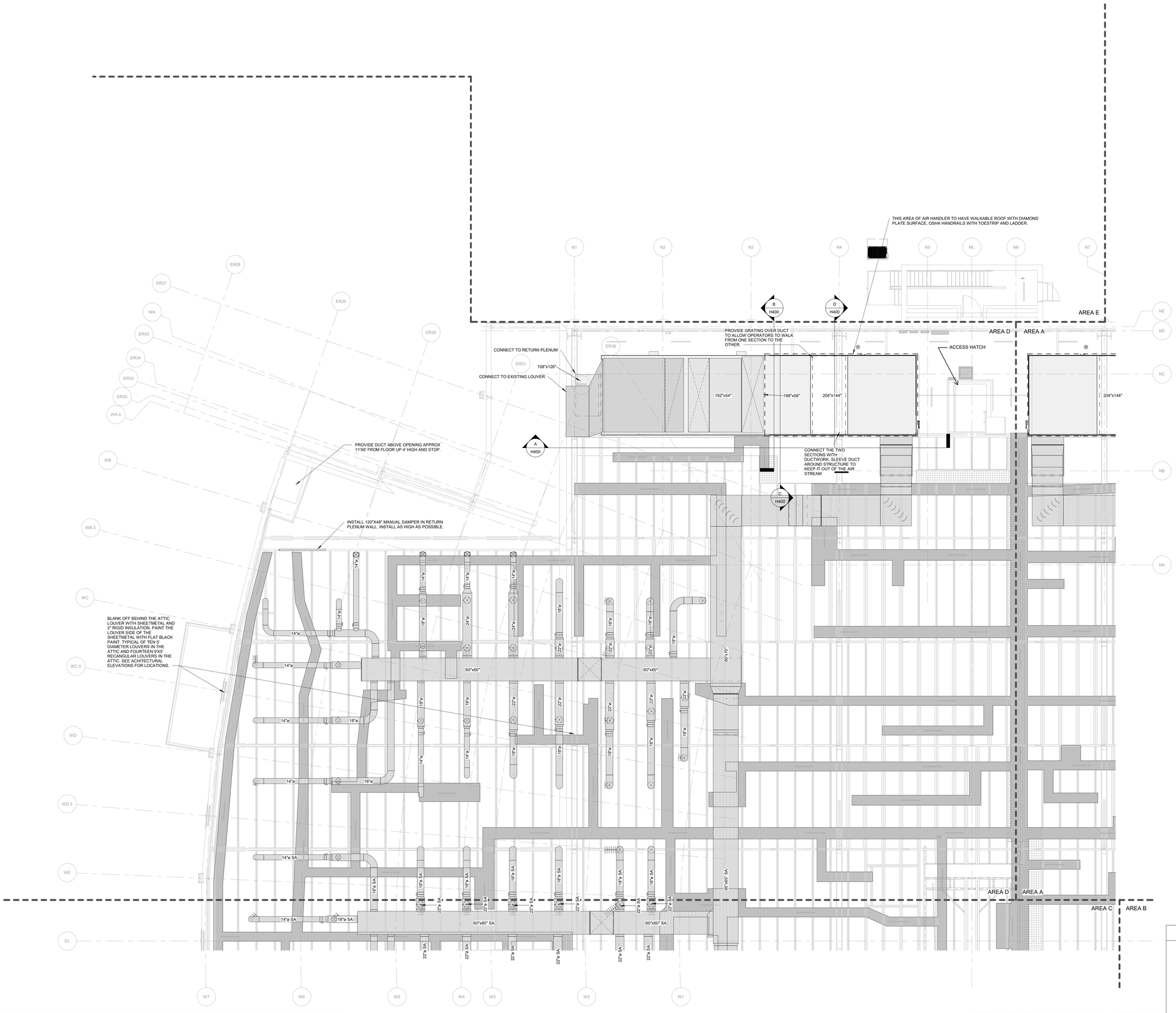
CONSTRUCTION DOCUMENTS

H240C

ATTIC LEVEL HVAC PLAN - AREA C

DATE ISSUED:
MARCH 26, 2021

ROOM SCHEDULE: ATTIC	
ROOM NUMBER	ROOM NAME
A300A	ATTIC
D300A	ATTIC MEZZ.



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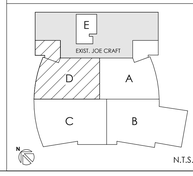
ATTIC LEVEL HVAC PLAN - AREA D

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

KEY PLAN



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3064 Lochness Drive
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NOT FOR CONSTRUCTION

ATTIC LEVEL HVAC PLAN - AREA D

IMPROVE MEMORIAL COLISEUM
FOR:
THE UNIVERSITY OF KENTUCKY
LEXINGTON, KENTUCKY

Architect of Record:
Civil Engineer:
Landscape Architect:
RossTarrant Architects, Inc.
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Lexington, Kentucky 40505
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MEP Engineer:
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p 859.271.3246

UK#: 2520.0
Project No: 1924
Drawn By: AL
Rev'd By: CK

ISSUED FOR:

REVISIONS

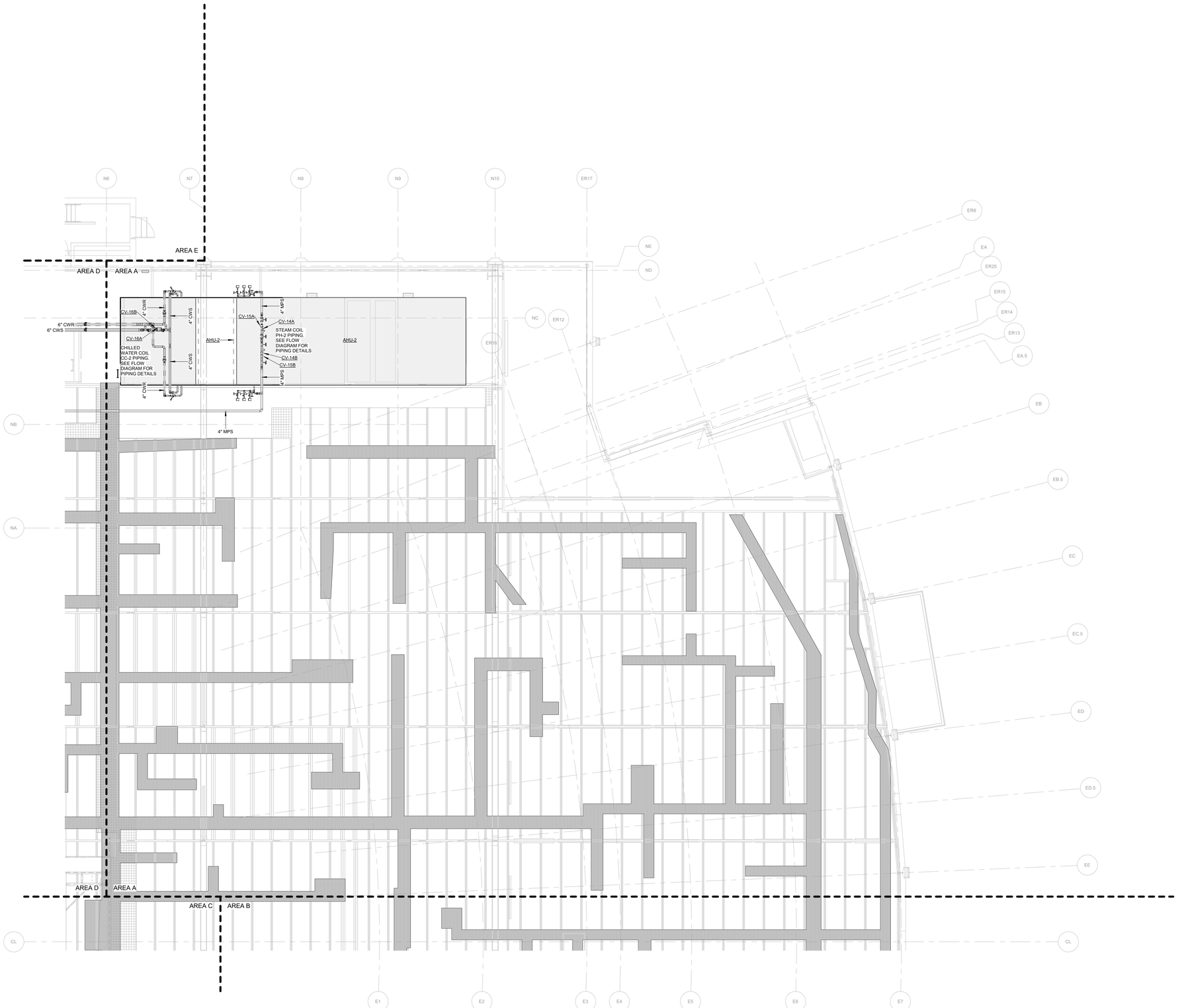
#	DATE	DESCRIPTION

CONSTRUCTION DOCUMENTS

H240D

ATTIC LEVEL HVAC PLAN - AREA D

DATE ISSUED:
MARCH 26, 2021



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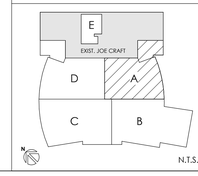
ATTIC LEVEL HVAC PIPING PLAN - AREA A
SCALE: 1/8" = 1'-0"

KEY PLAN



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3264 Lochness Drive
Lexington KY 40517
859-271-3246

NOT FOR CONSTRUCTION

ATTIC LEVEL HVAC PIPING PLAN - AREA A

IMPROVE MEMORIAL COLISEUM
FOR:
THE UNIVERSITY OF KENTUCKY
LEXINGTON, KENTUCKY

Architect of Record:
Civil Engineer:
Landscape Architect:
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UK#
Project No: 1924
Drawn By: AL
Rev'd By: CK

ISSUED FOR:

REVISIONS

#	DATE	DESCRIPTION

CONSTRUCTION DOCUMENTS

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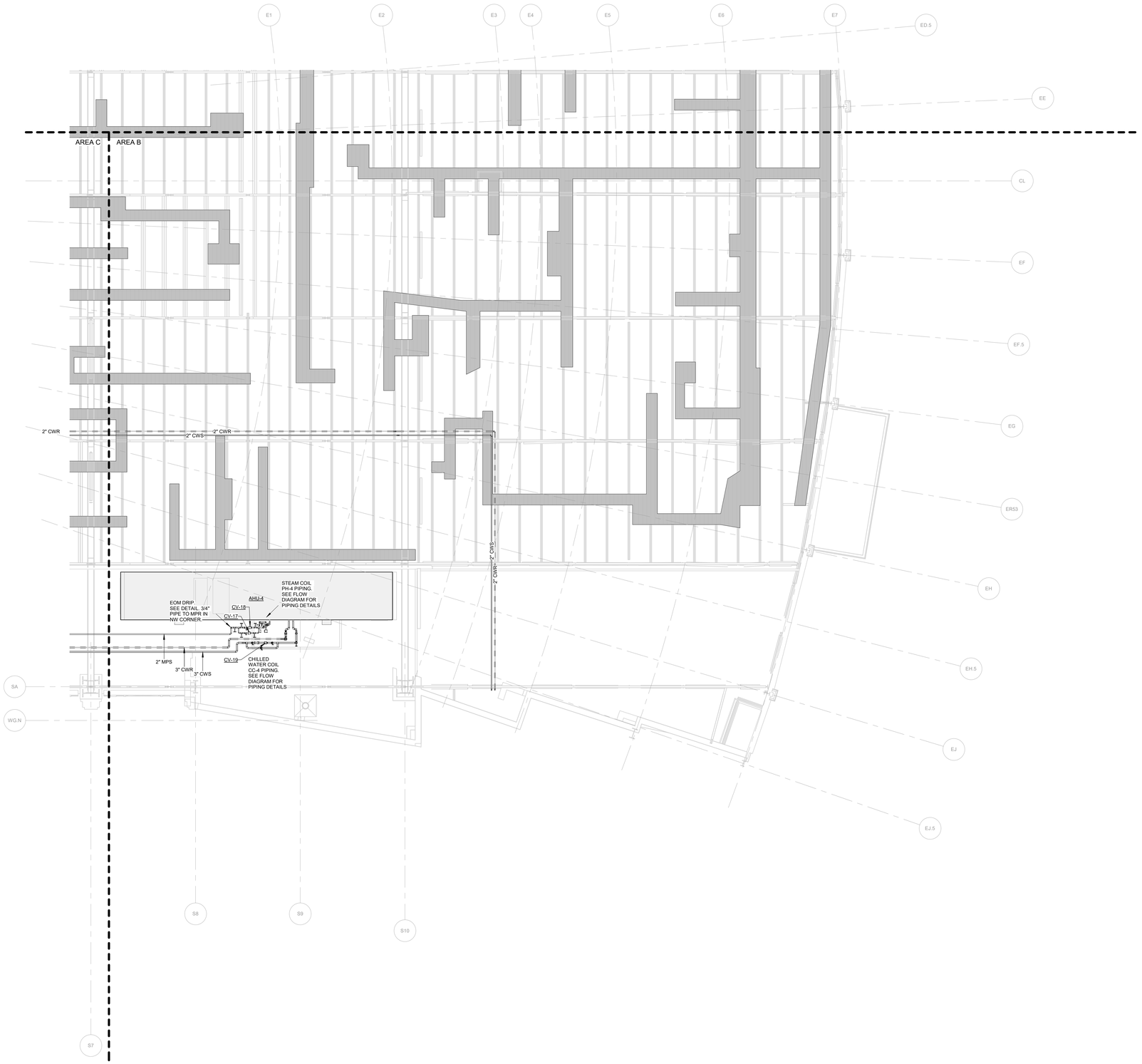
ATTIC LEVEL HVAC PIPING PLAN - AREA A

DATE ISSUED:
MARCH 26, 2021



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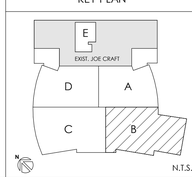
ATTIC LEVEL HVAC PIPING PLAN - AREA B

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

KEY PLAN



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859-271-3246

NOT FOR CONSTRUCTION

ATTIC LEVEL HVAC PIPING PLAN - AREA B

IMPROVE MEMORIAL COLISEUM

FOR:

THE UNIVERSITY OF KENTUCKY

LEXINGTON, KENTUCKY

Architect of Record:
Civil Engineer:
Landscape Architect:
RossTarrant Architects, Inc.
101 Old Lafayette Avenue
Lexington, Kentucky 40502
p 859.254.4018

Signature Sports Architect:
HNTB Corporation
715 Kirk Drive
Kansas City, Missouri 64105
p 816.472.1201

Structural Engineer of Record:
Brown + Kubican, PSC
2224 Young Drive
Lexington, Kentucky 40505
p 859.543.0933

MEP Engineer:
Staggs & Fisher Consulting Engineer
3264 Lochness Drive
Lexington, Kentucky 40517
p 859.271.3246

UK# 2520.0

Project No: 1924
Drawn By: AL
Rev'd By: CK

ISSUED FOR:

REVISIONS

#	DATE	DESCRIPTION

CONSTRUCTION DOCUMENTS

H340B

ATTIC LEVEL HVAC PIPING PLAN - AREA B

DATE ISSUED:
MARCH 26, 2021

NOTE:

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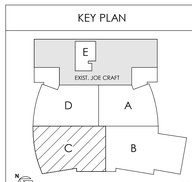
ATTIC LEVEL HVAC PIPING PLAN - AREA C

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

KEY PLAN



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LEXINGTON, KENTUCKY

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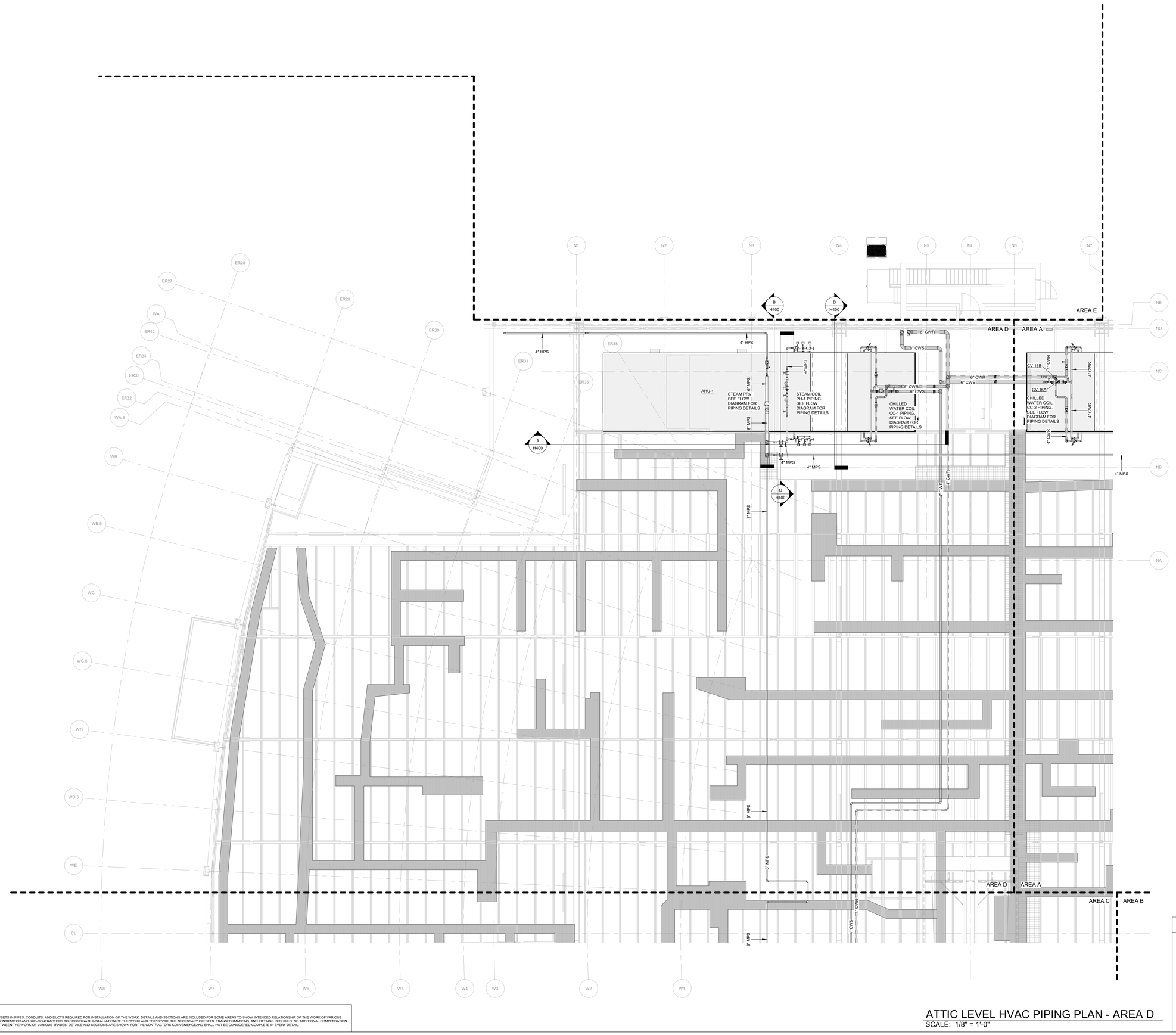

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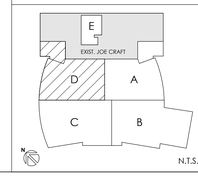
ATTIC LEVEL HVAC PIPING PLAN - AREA D

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

KEY PLAN



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NOT FOR CONSTRUCTION

ATTIC LEVEL HVAC PIPING PLAN - AREA D

IMPROVE MEMORIAL COLISEUM
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LEXINGTON, KENTUCKY

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UK# 2520.0

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H340D

ATTIC LEVEL HVAC PIPING PLAN - AREA D

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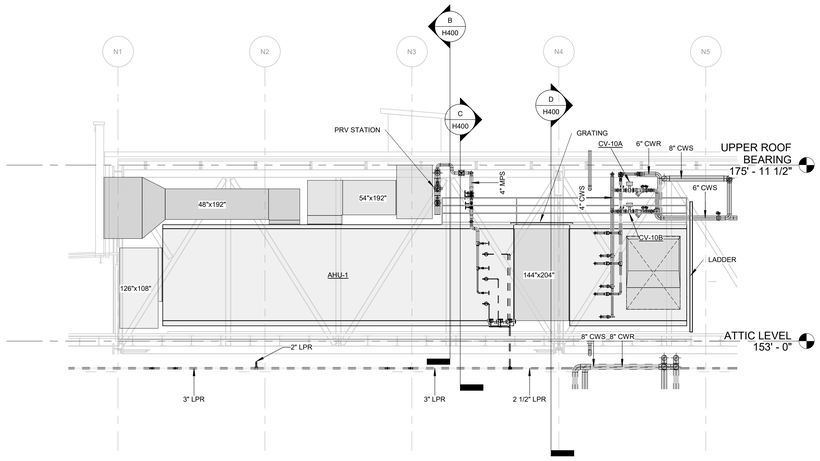
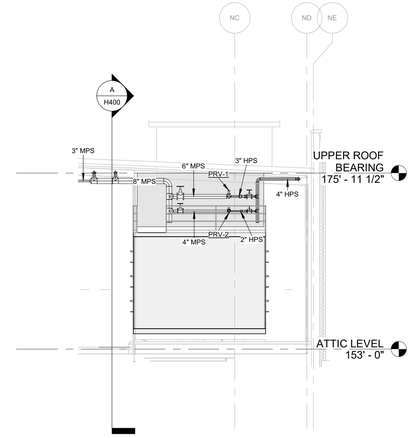
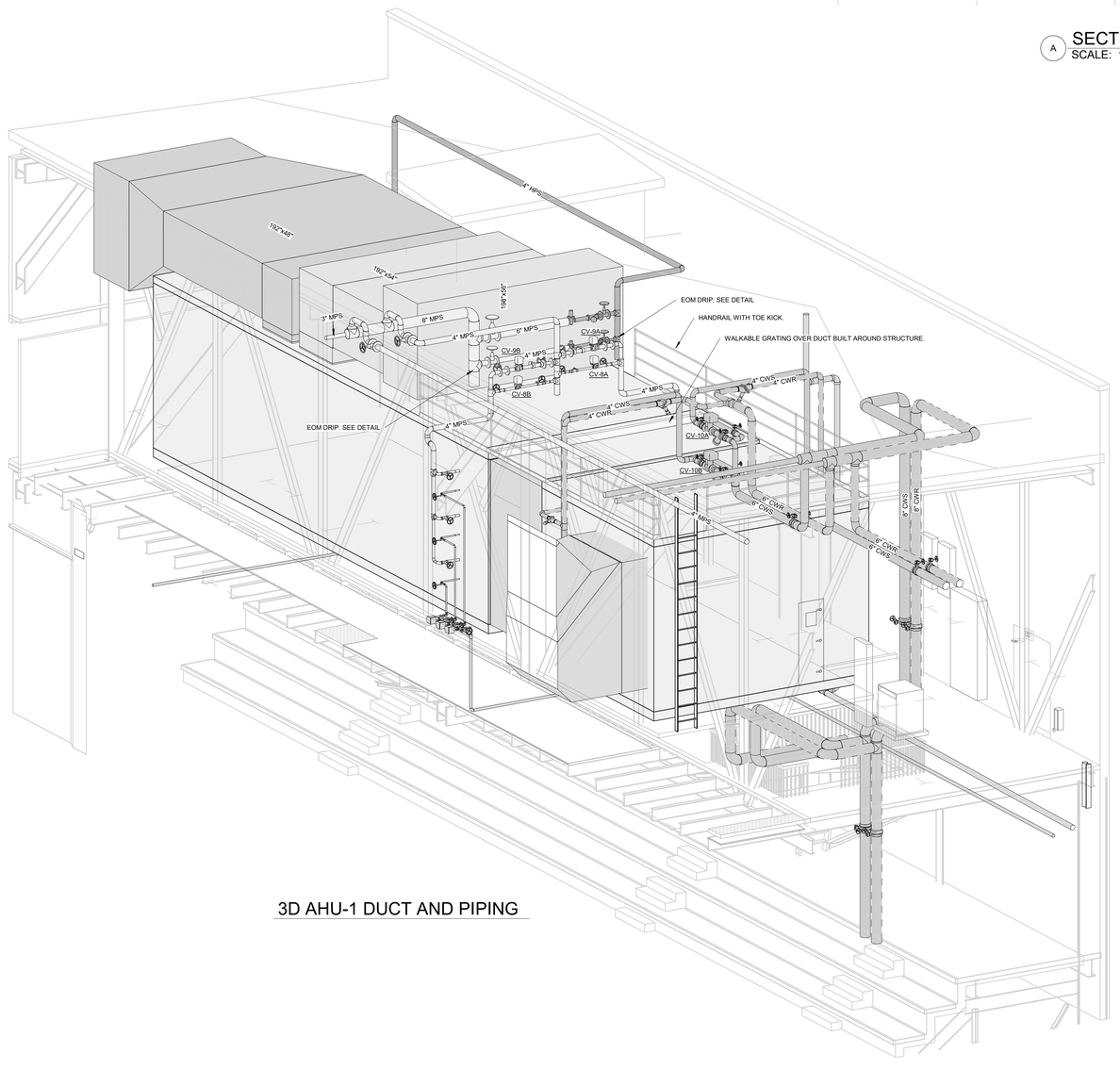


A SECTION A
SCALE: 1/8" = 1'-0"



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



3D AHU-1 DUCT AND PIPING

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

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

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NOT FOR CONSTRUCTION

HVAC SECTIONS

IMPROVE MEMORIAL COLISEUM

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LEXINGTON, KENTUCKY

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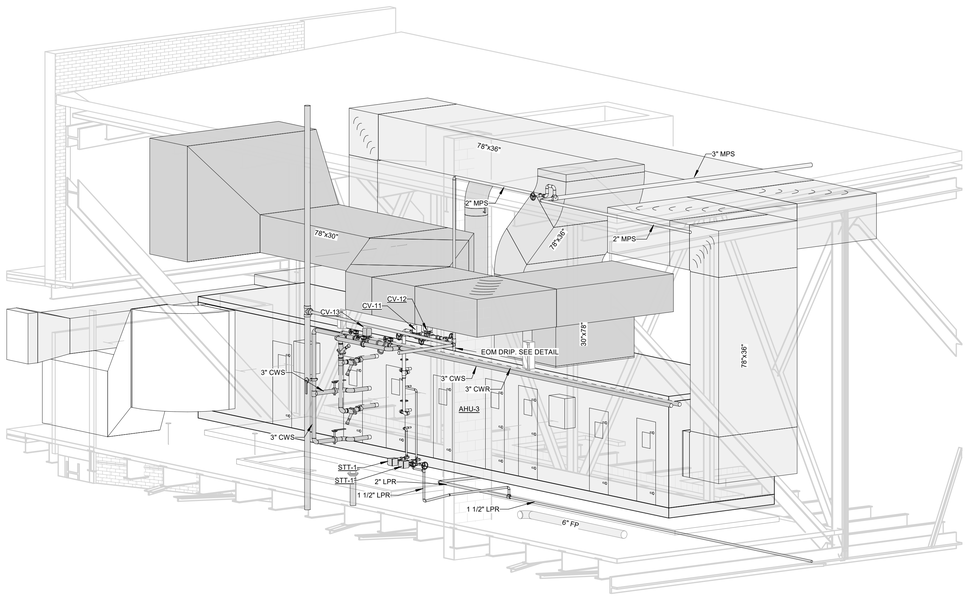
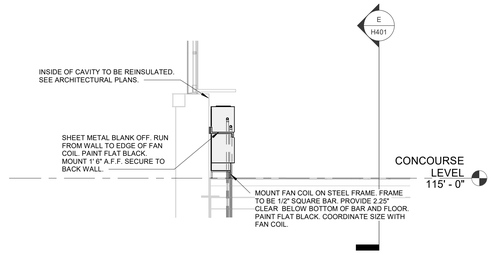
H400
HVAC SECTIONS

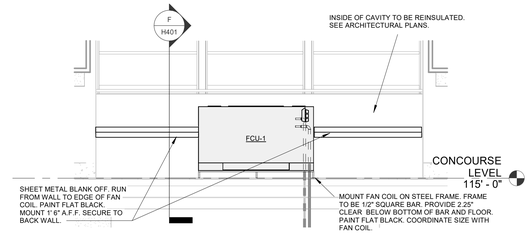
DATE ISSUED:
MARCH 26, 2021



3D AHU-3 DUCT AND PIPING



F SECTION F (TYPICAL CONCOURSE FAN COIL)
SCALE: 1/2" = 1'-0"



E SECTION E (TYPICAL CONCOURSE FAN COIL)
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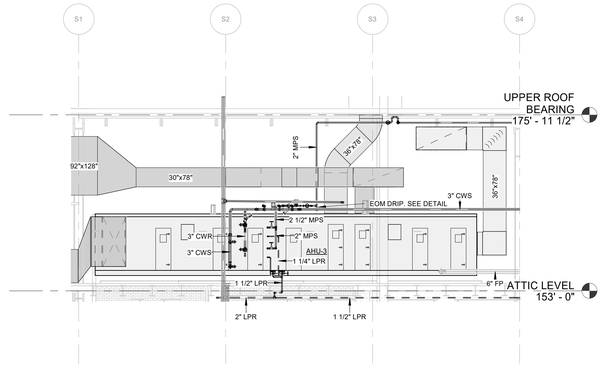
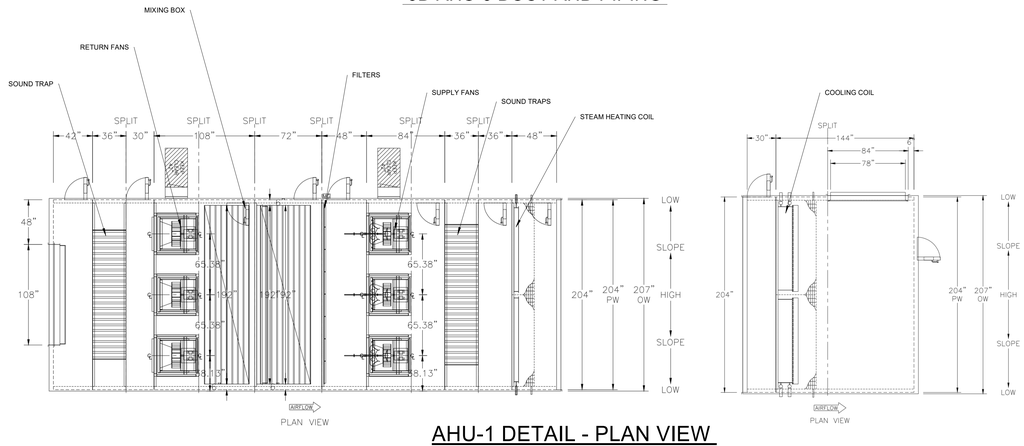
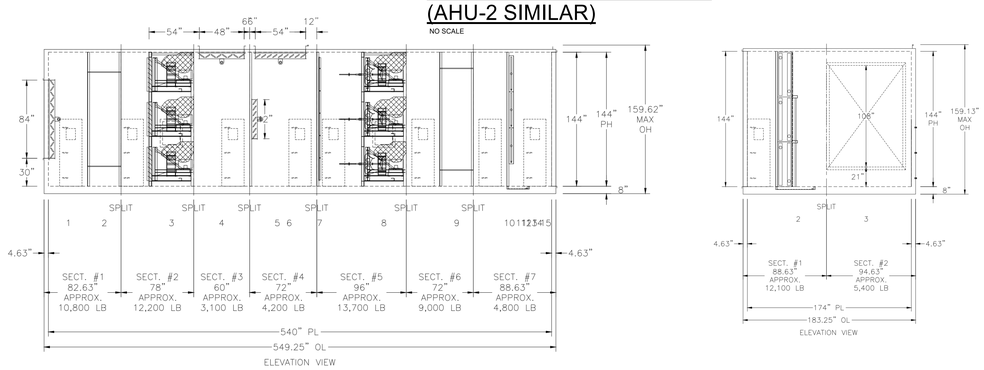


G SECTION G
SCALE: 1/8" = 1'-0"



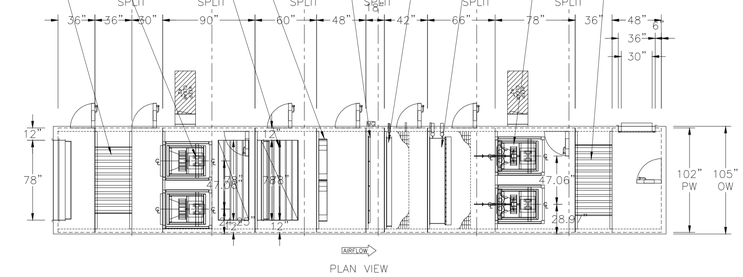
AHU-1 DETAIL - PLAN VIEW (AHU-2 SIMILAR)

NO SCALE



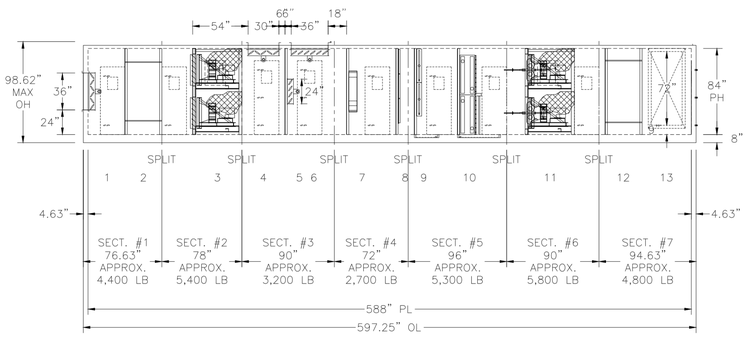
AHU-1 DETAILS - SECTION VIEW (AHU-2 SIMILAR)

NO SCALE



AHU-3 DETAIL - PLAN VIEW (AHU-4 SIMILAR)

NO SCALE



AHU-3 DETAILS - SECTION VIEW (AHU-4 SIMILAR)

NO SCALE

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HVAC SECTIONS

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H401

HVAC SECTIONS

DATE ISSUED:
MARCH 26, 2021

COOLING COIL

SYMBOL	MANUFACTURER	MODEL	ROWS	F.P.I.	MAX CFM	VEL. FPM	A.P.D.IN W.G.	ENTERING AIR D.B.	ENTERING AIR W.B.	LEAVING AIR D.B.	LEAVING AIR W.B.	GPM	E.W.T.	P.D. IN FT.	DIMEN. HxW	REMARKS
CC-1	CLIMATE CRAFT	58WC45X087-08-10-AW	8	10	80,000	490	0.82	78	65	51.4	51.2	380	44	16.6	*1	*2
CC-2	CLIMATE CRAFT	58WC45X087-08-10-AW	8	10	80,000	490	0.82	78	65	51.4	51.2	380	44	16.6	*1	*2
CC-3	CLIMATE CRAFT	58WC36X083-08-09-AW	8	9	20,000	482	0.71	78	65	52.8	52.6	87	44	4.2	*3	*2
CC-4	CLIMATE CRAFT	58WC36X083-08-09-AW	8	9	20,000	482	0.71	78	65	52.8	52.6	87	44	4.2	*3	*2

REMARKS:

*1 6 COILS, EACH AT 45" HIGH, 87" LONG, 3" CONNECTIONS. BOLT OFF TO BE REMOVED THROUGH PLENUM DOOR.

*2 STAINLESS STEEL HEADERS, 0.01" FINS, 0.035" TUBES. PROVIDE WITH MISTOP MIST ELIMINATOR.

*3 2 COILS, EACH AT 36" HIGH, 83" LONG, 3" CONNECTIONS. BOLT OFF TO BE REMOVED THROUGH PLENUM DOOR.

CUSTOM AIR HANDLING UNITS

SYMBOL	MANUFACTURER	MODEL	SIZE	A.C.C.	MAX CFM	MIN. O.A. *4	SUPPLY E.S.P. IN. W.G.	RETURN E.S.P. IN. W.G.	SUPPLY FAN NUMBER	RETURN FAN NUMBER	COOLING COIL NO.	HEATING COIL NO.	FILTER	REMARKS
AHU-1	CLIMATE CRAFT	*1	*2	*3	80,000	11,460	1.0	0.75	SF-1	RF-1	CC-1	PH-1	*5	*6
AHU-2	CLIMATE CRAFT	*1	*2	*3	80,000	11,460	1.0	0.75	SF-2	RF-2	CC-2	PH-2	*5	*6
AHU-3	CLIMATE CRAFT	*1	*7	*8	20,000	2,000	2.75	0.75	SF-3	RF-3	CC-3	PH-3	*9	*10
AHU-4	CLIMATE CRAFT	*1	*7	*8	20,000	2,000	2.75	0.75	SF-4	RF-4	CC-4	PH-4	*9	*10

REMARKS:

*1 CUSTOM KNOCKDOWN. UNIT MUST FIT THROUGH OPENINGS PROVIDED. COORDINATE WITH CONSTRUCTION MANAGER.

*2 PROVIDE IN TWO PIECES. FIRST 549.25" LONG, 159.13" TALL, 207" WIDE. SECOND 193.25" LONG, 159.13" TALL AND 207" WIDE. THE TWO PIECES WILL BE CONNECTED BY THE MECH CONTRACTOR WITH INSULATED SHEET METAL SLEEVED AROUND EXISTING STRUCTURE.

*3 PROVIDE WALKABLE GRATE WITH OSHA HANDRAILS AND TOE STRIP OVER THE TWO SECTIONS. PORTION SHOWN ON PLAN TO HAVE WALKABLE ROOF WITH DIAMOND PLATE SURFACE, OSHA HADRAILS TOE STRIP AND LADDER. UNIT TO BE PROVIDED WITH RETURN SOUND TRAPS, RETURN FANS, MIXING BOX WITH ECONOMIZER, PREFILTERS, SUPPLY FANS, SUPPLY SOUND TRAPS, COOILNG COILS, DISCHARGE PLENUM.

*4 AT FULL OCCUPANCY.

*5 MERV 10 PLEATED FILTER RACK. 40-24X24 AND 8-12X24 FILTERS. PROVIDE MAGNEHELIC ACROSS FILTER RACK.

*6 SUPPLY OUTLET SOUND POWER LEVELS: 63/86, 125/86, 250/85, 500/70, 1000/67, 2000/71, 4000/66, 8000/65. RETURN INLET SOUND POWER LEVELS: 63/80, 125/85, 250/78, 500/66, 1000/67, 2000/71, 4000/66, 8000/59.

*7 597.25" LONG, 98.62" TALL, 105" WIDE.

*8 UNIT TO BE PROVIDED WITH RETURN SOUND TRAPS, RETURN FANS, MIXING BOX WITH ECONOMIZER, PREFILTERS, SUPPLY FANS, SUPPLY SOUND TRAPS, COOILNG COILS, DISCHARGE PLENUM.

*9 MERV 10 PLEATED FILTER RACK. 9-24X24 AND 3-12X24 FILTERS. PROVIDE MAGNEHELIC ACROSS FILTER RACK.

*10 SUPPLY OUTLET SOUND POWER LEVELS: 63/82, 125/86, 250/76, 500/69, 1000/61, 2000/64, 4000/61, 8000/66. RETURN INLET SOUND POWER LEVELS: 63/69 125/70, 250/69, 500/59, 1000/60, 2000/64, 4000/59, 8000/52.

FAN COIL UNITS

SYMBOL	MANUFACTURER	MODEL	MOTOR CFM	MOTOR E.S.P. IN W.C.	MOTOR HP	MOTOR PH	MOTOR VOLTS	CHILLED WATER COIL E.A.T. DEG F (DB/WB)	CHILLED WATER COIL E.W.T. DEG. F	CHILLED WATER COIL GPM	CHILLED WATER COIL WATER P.D. (FT)	CHILLED WATER COIL MBH (TOTAL/SENSIBLE)	HOT WATER COIL E.A.T. DEG. F	HOT WATER COIL E.W.T. DEG. F	HOT WATER COIL GPM	HOT WATER COIL WATER P.D. (FT)	HOT WATER COIL MBH	REMARKS
FCU-1	IEC	FXY03	249	---	0.03	1	115	---	---	---	---	---	70	180	1.7	3.6	17.1	*1
FCU-2	IEC	VDY20	2400	0.5	1	3	208	75/63	45	11.9	7.3	59.8/48.3	70	180	5.1	6.1	75.8	*2

REMARKS:

*1 FAN COIL TO BE PROVIDED WITH CABINET PAINTED FLAT BLACK. CRITICAL DIMENSIONS, DEPTH OF CABINET IS 9" MAX., HEIGHT OF CABINET 25" MAX., PROVIDE WITH 3 SPEED MOTOR, STAMPED SUPPLY GRILLE ON TOP OF CABINET, FRONT FILTER ACCESS. SOUND POWER: 125/65, 250/64, 500/59, 1K/55, 2K/47, 4K/44, 8K/38.

*2 UNIT WITH VARIABLE SPEED EC MOTOR, 2" PLEATED MERV 8 FILTER, MANUAL AIR VENT WITH DRAIN, DOUBLE WALL CONSTRUCTION, AND CONDENSATE FLOAT SWITCH.

PUMP SCHEDULE

SYMBOL	MANUFACTURER	MODEL	SIZE	GPM	HEAD FT.	BHP	HP	MOTOR RPM	MOTOR PH	MOTOR VOLTS	SHUT OFF HEAD FT.	END OF CURVE FLOW-GPM	TYPE	REMARKS
CWP-1	BELL & GOSSETT	e-1510	5EB	930	75	21.2	25	1800	3	480	95	1350	*1	*2, *3, *4
HWP-1	BELL & GOSSETT	e-1532	1.25BC	105	75	3.72	5	1800	3	480	102	110	*1	*2, *3
HWP-2	BELL & GOSSETT	e-1532	1.25BC	105	75	3.72	5	1800	3	480	102	110	*1	*2, *3

REMARKS:

*1 CLOSE COUPLED FOOT MOUNTED END SUCTION PUMP.

*2 PROVIDE WITH SUCTION DIFFUSER WITH STARTUP STRAINER.

*3 MOTORS TO BE INVERTER DUTY RATED.

*4 PUMP IS TO BE RATED FOR 250 PSIG.

STEAM HEATING COILS

SYMBOL	MANUFACTURER	MODEL	ROWS	F.P.I.	MAX CFM	VEL. FPM	A.P.D.IN W.G.	ENTERING AIR D.B. (F)	LEAVING AIR D.B. (F)	#/HR OF STEAM	ENT. STEAM PSIG	DIMEN. HxW	REMARKS
PH-1	CLIMATE CRAFT	11SD-36X90-5-1-W-Z	1	5	80,000	593	0.10	50	85.2	3,194	15	*1	*2
PH-2	CLIMATE CRAFT	11SD-36X90-5-1-W-Z	1	5	80,000	593	0.10	50	85.2	3,194	15	*1	*2
PH-3	CLIMATE CRAFT	11SD-30X86-5-1-W-Z	1	5	20,000	558	0.09	50	86.4	828	15	*3	*2
PH-4	CLIMATE CRAFT	11SD-30X86-5-1-W-Z	1	5	20,000	558	0.09	50	86.4	828	15	*3	*2

REMARKS:

*1 6 COILS, EACH AT 36" HIGH, 90" LONG, 1" CONNECTIONS. BOLT OFF TO BE REMOVED THROUGH PLENUM DOOR.

*2 "FREEZE RESISTANT" COILS, 0.01" FINS, 0.035" TUBES.

*3 2 COILS, EACH AT 30" HIGH, 86" LONG, 1" CONNECTIONS. BOLT OFF TO BE REMOVED THROUGH PLENUM DOOR.

STEAM TRAPS

SYMBOL	MANUFACTURER	TYPE	MODEL	ORF. SIZE (INCH)	MAX. OPERATING PRESSURE (PSIG)	CONNECTION SIZE (INCH)	CAPACITY (LBS/HR)	SIZING DIFF. PRESSURE (PSIG)	REMARKS
STT-1	BELL & GOSSETT	F&T	FT030C-6	0.39	30	1-1/2"	1000	1/4	*1

REMARKS:

*1 CAST IRON BODY, STAINLESS STEEL PIN, LEVER ASSEMBLY SEAT, AIR VENT AND FLOAT, ALLOW FOR SERVICE WITHOUT REMOVING FROM PIPING.

INDOOR UNITS

SYMBOL	MANUFACTURER	TYPE	MODEL	CAPACITIES (*3) COOLING (MBH)	CAPACITIES (*3) HEATING (MBH)	AIRFLOW CFM (HIGH/LOW)	REFRIGERANT	UNIT DATA UNIT BODY DIMENSIONS (IN) H	W	D	UNIT PANEL DIMENSIONS (IN) H	W	D	SOUND PRESSURE (dBA) *2	ELECTRICAL DATA POWER SUPPLY	RATED AMPS	MAX POWER INPUT (W)	REMARKS
C-36	LG	CEILING CASSETTE	ARNU	36.2	---	918/706	R410A	11-5/16"	33-1/16"	33-1/16"	1-7/16"	37-3/8"	37-3/8"	44/37	208-230/1	1.3	64	*2, *3, *4, *5
D-07	LG	DUCTED	ARNU	7.5	---	270 (@ 0.1" ESP)/200	R410A	7-1/2"	28-7/8"	27-9/16"	---	---	---	27/23	208-230/1	0.4	40	*2, *3, *4, *5
WM-07	LG	WALL MOUNT	ARNU	7.5	---	254/208	R410A	12-7/16"	32-3/16"	7-7/16"	---	---	---	32/28	208-230/1	0.25	30	*1, *2, *3, *4, *5, *6
WM-36	LG	WALL MOUNT	ARNU	35.5	---	918/671	R410A	13-5/8"	46-27/32"	10-7/16"	---	---	---	52/43	208-230/1	0.81	104	*1, *2, *3, *4, *5, *6

REMARKS:

1. UNIT TO BE MOUNTED AS CLOSE TO THE CEILING AS POSSIBLE PER MANUFACTURERS INSTALLATION SPECIFICATION UNLESS OTHERWISE NOTED.
2. PROVIDE AND INSTALL TATTOO SERIES CONDENSATE PUMP, SIZED FOR INDOOR UNIT.
3. RATED COOLING CONDITIONS: 80/67 DEB F INDOOR AND 95/75 DEG F AMBIENT
   RATED HEATING CONDITIONS: 70 DEG F INDOOR AND 47 DEG F AMBIENT
4. PROVIDE MANUFACTURERS CENTRAL CONTROLLER WITH CAMPUS DDC INTERFACE.
5. REFRIGERANT PIPE SIZES AND ROUTING ADJUSTMENTS SHALL BE BY MANUFACTURER. LAYOUT ON DRAWINGS IS DIAGRAMATIC AND TO SHOW INTENDED SYSTEM ZONING.
6. WHERE REFRIGERANT AND CONDENSATE PIPING IS EXPOSED, PROVIDE "NICE" COVER SYSTEM TO CONCEAL PIPING.

INVERTER HEAT PUMP UNITS

SYMBOL	MANUFACTURER	MODEL	COOLING DATA *1 CAPACITY (MBH)	COOLING DATA *1 INPUT POWER (KW)	HEATING DATA *2 CAPACITY (MBH)	HEATING DATA *2 INPUT POWER (KW)	COMPRESSOR TYPE	COMPRESSOR CAPACITY CONTROL RANGE	REFRIGERANT TYPE	REFRIGERANT BASE CHARGE (LBS.)	EER (NON-DUCTED/DUCTED)	SOUND PRESSURE (dBA)	ELECTRICAL DATA POWER SUPPLY	MIN CIRCUIT AMPS	MOP (A)	RATED AMPS	REMARKS
OU-1	LG	ARUM	216.0	15.37	---	---	HSS DC SCROLL	14% - 100%	R-410A	37.5	11.2/10.7	64	460/3	38.3	50	34.4	*1, *2, *3, *4
OU-2	LG	ARUM	233.1	16.8	---	---	HSS DC SCROLL	14% - 100%	R-410A	37.5	10.4/10.4	65	460/3	41.4	50	37.2	*1, *2, *3, *4
OU-3	LG	ARUM	216.0	15.37	---	---	HSS DC SCROLL	14% - 100%	R-410A	37.5	11.2/10.7	64	460/3	38.3	50	34.4	*1, *2, *3, *4
OU-4	LG	ARUM	216.0	15.37	---	---	HSS DC SCROLL	14% - 100%	R-410A	37.5	11.2/10.7	64	460/3	38.3	50	34.4	*1, *2, *3, *4
OU-5	LG	ARUM	216.0	15.37	---	---	HSS DC SCROLL	14% - 100%	R-410A	37.5	11.2/10.7	64	460/3	38.3	50	34.4	*1, *2, *3, *4

REMARKS:

1. RATED COOLING CONDITIONS (DEGREES F): INDOOR - 80 DB / 67 WB, AMBIENT - 95 DB / 75 WB.
2. RATED HEATING CONDITIONS (DEGREES F): INDOOR - 70 DB / 60 WB, AMBIENT - 47 DB / 43 WB (UNIT SHALL HEAT TO -4 DEG F).
3. PROVIDE MANUFACTURERS CENTRAL CONTROLLER WITH CAMPUS DDC INTERFACE.
4. REFRIGERANT PIPE SIZES AND ROUTING SHALL BE BY MANUFACTURER. LAYOUR ON DRAWINGS IS DIAGRAMTIC AND TO SHOW INTENDED SYSTEM ZONING.

VARIABLE VOLUME TERMINAL UNITS

SYMBOL	MANUFACTURER	MODEL	CFM MIN	CFM MAX	DISCHARGE NC @ 3.0" W.C.	DUCT SIZE INLET	DUCT SIZE OUTLET	STATIC DP IN W.G.	ASSOCIATED REHEAT COIL	ASSOCIATED SOUND TRAP NO.	REMARKS
VAV-5	ENVIRO-TEC	SDR	90	300	31	5"	9"x9"	0.01	HC-1, HC-2	ST-1	*1,*2,*3,*4,*5
VAV-6	ENVIRO-TEC	SDR	100	400	33	6"	9"x9"	0.10	HC-1, HC-2	ST-1	*1,*2,*3,*4,*5
VAV-8	ENVIRO-TEC	SDR	190	700	33	8"	11"x9"	0.03	HC-3, HC-4	ST-2	*1,*2,*3,*4,*5
VAV-10	ENVIRO-TEC	SDR	305	1100	34	10"	13"x11"	0.02	HC-5, HC-6	ST-3	*1,*2,*3,*4,*5
VAV-12	ENVIRO-TEC	SDR	440	1600	33	12"	15"x14"	0.02	HC-7, HC-8	ST-4	*1,*2,*3,*4,*5
VAV-14	ENVIRO-TEC	SDR	615	2200	33	14"	19"x16"	0.05	HC-9, HC-10	ST-5	*1,*2,*3,*4,*5
VAV-16	ENVIRO-TEC	SDR	800	3000	35	16"	23"x16"	0.04	HC-11, HC-12	ST-6	*1,*2,*3,*4,*5

REMARKS:

*1 DOUBLE WALL CONSTRUCTION; NO PORTION OF THE AIRSTREAM SHALL BE IN CONTACT WITH THE INSULATION.

*2 LOW LEAKAGE DAMPER WITH CLOSED CELL FOAM GASKET.

*3 SELF-LUBRICATING BEARINGS.

*4 MULTI-AXIS, CENTER AVERAGING AIRFLOW SENSOR.

*5 SOUND POWER LEVELS LISTED ARE AT THE MAXIMUM CFM.

REHEAT COILS

SYMBOL	MANUFACTURER	MODEL	ROWS	F.P.I.	MAX CFM	VEL. FPM	A.P.D.	GPM	W.P.D. IN FT.	WATER VEL.	E.A.T. (F.)	E.W.T. (F.)	HEATING CAP.(MBH)	L.A.T. (F.)	DIM. WxH	REMARKS
RH-1	DAIKIN	5BS0602B	2	6	400	400	0.08	1.0	0.56	1.10	55.0	135	16.6	93.3	12"x12"	VAV-5 & VAV-6 *1
RH-2	DAIKIN	5BS0802A	2	8	400	400	0.07	2.0	1.50	1.63	55.0	135	21.2	103.9	12"x12"	VAV-5 & VAV-6 *1
RH-3	DAIKIN	5BS0802B	2	8	700	560	0.18	1.0	0.62	1.10	55.0	135	26.9	90.5	15"x12"	VAV-8 *1
RH-4	DAIKIN	5BS0902B	2	9	700	560	0.20	2.0	2.01	2.18	55.0	135	35.1	101.3	15"x12"	VAV-8 *1
RH-5	DAIKIN	5BS0902B	2	9	1100	502	0.16	1.0	0.89	1.10	55.0	135	39.7	99.4	21"x15"	VAV-10 *1
RH-6	DAIKIN	5BS1002B	2	10	1100	502	0.18	2.0	2.90	2.18	55.0	135	55.4	101.4	21"x15"	VAV-10 *1
RH-7	DAIKIN	5BS0901A	1	9	1600	568	0.20	2.0	3.31	2.18	55.0	135	66.2	93.1	27"x15"	VAV-12 *1
RH-8	DAIKIN	5BD1002B	2	10	1600	568	0.22	3.0	1.04	1.63	55.0	135	75.9	98.8	27"x15"	VAV-12 *1
RH-10	DAIKIN	5BD1002B	2	10	2200	586	0.23	4.0	2.00	2.18	55.0	135	105.2	99.1	36"x15"	VAV-14 *1
RH-12	DAIKIN	5WH0902B	2	9	3000	500	0.18	8.0	0.6	1.6	55.0	135	150.4	100.9	48"x18"	VAV-16 *1

REMARKS:

*1 0.0095 ALUMINUM FINS AND 0.035 COPPER TUBES.

SOUND TRAPS

SYMBOL	MANUFACTURER	MODEL	DIMEN. WxHxL	MAX CFM	FACE VEL. FPM	P.D. IN. W.G.	INSERTION LOSS dB 1	2	3	4	5	6	7	8	SELF GEN. NOISE dB 1	2	3	4	5	6	7	8	REMARKS
ST-1	IAC	HS	12x12x36	400	400	0.03	7	9	14	19	20	28	30	13	36	29	35	30	31	35	22	20	*1
ST-2	IAC	HS	15x12x36	700	560	0.06	7	9	14	19	20	28	30	13	47	41	42	40	40	43	33	22	*1
ST-3	IAC	HS	21x15x36	1100	502	0.05	6	10	12	15	19	26	32	13	66	61	53	57	55	57	53	46	*1
ST-4	IAC	HS	27x15x36	1600	569	0.06	6	10	12	15	19	26	32	13	66	61	53	57	55	57	53	46	*1
ST-5	IAC	HS	36x15x36	2200	587	0.06	6	10	12	15	19	26	32	13	74	69	63	64	61	63	62	56	*1
ST-6	IAC	HS	48x18x36	3000	500	0.06	6	10	12	15	19	26	32	13	38	31	37	32	33	37	24	22	*1

REMARKS:

*1 FILM LINER TO PROTECT GLASS FIBER FROM AIRFLOW EROSION.

FANS

SYMBOL	MANUFACTURER	MODEL	TYPE	dBA ALL FANS INLET/OUTLET	CFM (TOTAL) N+1	S.P. IN. W.G.	FAN RPM	BHP (EACH)	MOTOR HP	MOTOR RPM	MOTOR PH	MOTOR VOLTS	WHEEL TYPE	WHEEL DIA.	REMARKS
SF-1	CLIMATE CRAFT	24MTX100	*2	97/98	79,063	3.34	1593	7.49	7.5	1175	3	460	PLENUM	24"	
SF-2	CLIMATE CRAFT	24MTX100	*2	97/98	79,063	3.34	1593	7.49	7.5	1175	3	460	PLENUM	24"	
SF-3	CLIMATE CRAFT	18TX75	*3	99/98	20,000	4.88	2635	9.77	15	3550	3	460	PLENUM	18"	
SF-4	CLIMATE CRAFT	18TX75	*3	99/98	20,000	4.88	2635	9.77	15	3550	3	460	PLENUM	18"	
RF-1	CLIMATE CRAFT	27MTX100	*1	89/89	68,540	1.3	977	2.66	5	875	3	460	PLENUM	27"	
RF-2	CLIMATE CRAFT	27MTX100	*1	89/89	68,540	1.3	977	2.66	5	875	3	460	PLENUM	27"	
RF-3	CLIMATE CRAFT	20MTX100	*4	82/84	18,000	1.3	1505	2.24	3	1175	3	460	PLENUM	20"	
RF-4	CLIMATE CRAFT	20MTX100	*4	82/84	18,000	1.3	1505	2.24	3	1175	3	460	PLENUM	20"	
EF-1	GREENHECK	BSQ-200	*5	72/--	5100	1.0	1189	1.94	2	1725	3	208	BACKWARD INCLINED	20"	*6

REMARKS:

*1 NINE FAN ARRAY DESIGNED N+1. ALL SELECTION DATA IS WITH 8 FANS RUNNING. FANS PROVIDED WITH OUTLET SCREEN, BACKDRAFT DAMPER, EXTENDED COPPER LUBE LINES. PIEZOMETRIC FLOW TAP - ALL FANS, ACOUSTIC BAFFLE, MOTOR SHAFT GROUNDING RINGS. SELECT ARRAY TO OPERATE WITH ALL FAN RUNNING OR WITH 1 OFF AT SAME CAPACITY.

*2 NINE FAN ARRAY DESIGNED N+1. ALL SELECTION DATA IS WITH 8 FANS RUNNING. FANS PROVIDED WITH OUTLET SCREEN, ADJUSTABLE WIDTH FAN WHEEL WITH SHUTOFF, EXTENDED COPPER LUBE LINES. PIEZOMETRIC FLOW TAP - ALL FANS, ACOUSTIC BAFFLE, MOTOR SHAFT GROUNDING RINGS, MOTOR REMOVAL WINCH. SELECT ARRAY TO OPERATE WITH ALL FAN RUNNING (80,000 CFM) OR WITH 1 OFF.

*3 FOUR FAN ARRAY DESIGNED N+1. ALL SELECTION DATA IS WITH 3 FANS RUNNING. FANS PROVIDED WITH OUTLET SCREEN, ADJUSTABLE WIDTH FAN WHEEL WITH SHUTOFF, EXTENDED COPPER LUBE LINES. PIEZOMETRIC FLOW TAP - ALL FANS, ACOUSTIC BAFFLE, MOTOR SHAFT GROUNDING RINGS, MOTOR REMOVAL WINCH. SELECT ARRAY TO OPERATE WITH ALL FAN RUNNING OR WITH 1 OFF AT SAME CAPACITY.

*4 FOUR FAN ARRAY DESIGNED N+1. ALL SELECTION DATA IS WITH 3 FANS RUNNING. FANS PROVIDED WITH OUTLET SCREEN, BACKDRAFT DAMPER, EXTENDED COPPER LUBE LINES. PIEZOMETRIC FLOW TAP - ALL FANS, ACOUSTIC BAFFLE, MOTOR SHAFT GROUNDING RINGS. SELECT ARRAY TO OPERATE WITH ALL FAN RUNNING OR WITH 1 OFF AT SAME CAPACITY.

*5 SINGLE INLINE FAN.

*6 BELT DRIVE CENTRIFUGAL INLINE FAN WITH MOTOR VFD RATED WITH SHAFT GROUNDING PROTECTION, AUTOMATIC BELT TENSIONER, GRIP NOTCH BELT(S), DISCONNECT, AND MOTORIZED BACKDRAFT DAMPER.

GRILLES, REGISTERS AND DIFFUSERS

SYMBOL	MANUFACTURER	MODEL	PANEL SIZE	DIFFUSER SIZE	INLET DIMENSIONS	CFM	P.D. (IN. W.G.)	THROW (FT)	DIRECTION OF THROW	NC	MOUNTING	REMARKS
S-1	PRICE	ASPD	24"x24"	12"x12"	5" RD	109	0.108	3-5-8	4-WAY	17	SEE PLANS	*1
S-2	PRICE	ASPD	24"x24"	20"x20"	6" RD	196	0.07	3-4-7	4-WAY	23	SEE PLANS	*1
S-3	PRICE	ASPD	24"x24"	20"x20"	8" RD	279	0.07	4-6-9	4-WAY	22	SEE PLANS	*1
S-4	PRICE	ASPD	24"x24"	20"x20"	10" RD	382	0.1	5-7-10	4-WAY	20	SEE PLANS	*1
S-5	PRICE	ASPD	24"x24"	24"x24"	12" RD	471	0.11	5-8-12	4-WAY	17	SEE PLANS	*1
S-6	PRICE	AMDA	24"x24"	24"x24"	18"x18"	900	0.065	16-19-27	4-WAY	21	SEE PLANS	*3
S-7	PRICE	ASPD	24"x24"	24"x24"	24" RD	641	0.127	5-7-13	4-WAY	18	SEE PLANS	*2
S-8	PRICE	620	---	12"x10"	12"x10"	415	0.093	9-13-18	45 DEG	17	SIDEWALL	*4
S-9	PRICE	LBMH	---	6"	---	314/FT	0.121	28-33-39	SIDEWALL	34	SIDEWALL	*5
S-10	PRICE	620	---	30"x4"	30"x4"	415	0.093	9-13-18	45 DEG	17	SIDEWALL	*7
S-11	PRICE	620	---	24"x4"	24"x4"	365	0.03	9-12-17	45 DEG	20	SIDEWALL	*7
R-1	PRICE	630	24"x24"	14"x14"	14"x14"	472	0.01	---	---	20	SEE PLANS	*6
R-2	PRICE	630	24"x24"	22"x22"	22"x22"	1244	0.01	---	---	21	SEE PLANS	*6
R-3	PRICE	LBMH	---	6"	---	314/FT	0.1	---	---	38	SIDEWALL	*5
E-1	PRICE	630	24"x24"	14"x14"	14"x14"	472	0.01	---	---	20	SEE PLANS	*6
E-2	PRICE	630	24"x24"	22"x22"	22"x22"	1244	0.01	---	---	21	SEE PLANS	*6

REMARKS:

*1 ALUMINUM PLAQUE DIFFUSER WITH INSULATED BACKPAN AND OFF WHITE FINISH. BLANK OFF DIFFUSER TO PROVIDE THROW DIRECTIONS OF OTHER THAN 4-WAY WHERE INDICATED ON DRAWINGS.

*2 ALUMINUM PLAQUE DIFFUSER WITH INSULATED BACKPAN AND CUSTOM FINISH SELECTED BY ARCHITECT. BLANK OFF DIFFUSER TO PROVIDE THROW DIRECTIONS OF OTHER THAN 4-WAY WHERE INDICATED ON DRAWINGS.

*3 ALUMINUM MODULAR LOUVERED FACE DIFFUSER WITH ADJUSTABLE PATTERN DEFLECTORS AND CUSTOM FINISH SELECTED BY ARCHITECT.

*4 ALUMINUM DOUBLE DEFLECTION SUPPLY GRILLE WITH INDIVIDUALLY ADJUSTABLE BLADES ON 3/4" CENTERS AND OFF-WHITE FINISH.

*5 ALUMINUM HEAVY DUTY MANDREL TUBE LINEAR BAR GRILLE WITH 3/16" BARS ON 7/16" CENTERS, REMOVABLE CORE, AND CUSTOM FINISH SELECTED BY ARCHITECT. PAINT DUCT BEHIND GRILLE FLAT BLACK.

*6 ALUMINUM LOUVERED RETURN/EXHAUST GRILLE WITH 45 DEGREE BLADES ON 3/4" CENTERS AND OFF WHITE FINISH. PAINT DUCT BEHIND RETURN GRILLE FLAT BLACK.

*7 ALUMINUM DOUBLE DEFLECTION SUPPLY GRILLE WITH INDIVIDUALLY ADJUSTABLE BLADES ON 1/2" CENTERS AND CUSTOM FINISH.

CONTROL VALVES

SYMBOL	MANUFACTURER	TYPE	SERVICE	GPM - LBS/HR	STEAM INLET PRESS (PSI)	DESIGN P.D. (PSI)	DESIGN P.D. (FT)	DESIGN Cv	SIZE	ACTUAL Cv	ACTUAL P.D. (PSI)	ACTUAL P.D. (FT)	DESIGN POINT % OF TRAVEL	RANGEABILITY	MIN. CLOSE OFF PRESS. (PSI)	RECOMM. OPER. P.D. (PSI)	RATED PRESSURE (PSI)	REMARKS
CV-1	JOHNSON	*1	HOT/CHILLED WATER	0.5 - 1.0	---	---	---	---	1/2"	0.7	2.0	4.7	---	50	100	100	175	VAV REHEAT & FAN COIL UNIT COIL *3, *4, *5
CV-2	JOHNSON	*1	HOT/CHILLED WATER	1.5 - 3.0	---	---	---	---	1/2"	1.7	3.1	7.2	---	50	100	100	175	VAV REHEAT & FAN COIL UNIT COIL *3, *4, *5
CV-3	JOHNSON	*1	HOT/CHILLED WATER	3.5 - 4.0	---	---	---	---	3/4"	3.0	1.8	4.1	---	50	100	100	175	VAV REHEAT & FAN COIL UNIT COIL *3, *4, *5
CV-4	JOHNSON	*1	HOT/CHILLED WATER	4.5 - 8.5	---	---	---	---	1"	5.8	2.1	4.9	---	50	100	100	175	VAV REHEAT & FAN COIL UNIT COIL *3, *4, *5
CV-5	JOHNSON	*1	HOT/CHILLED WATER	8.5 - 12.0	---	---	---	---	1"	6.4	3.5	8.1	---	50	100	100	175	VAV REHEAT & FAN COIL UNIT COIL *3, *4, *5
CV-6	NELES	*2	CHILLED WATER	930.0	---	4.3	10.0	446.0	6"	1260.0	1.3	0.5	78.3	75	100	100	250	MAIN CHILLED WATER BUILDING VALVE
CV-7	NELES	*2	CHILLED WATER	930.0	---	4.3	10.0	446.0	6"	1260.0	1.3	0.5	78.3	75	100	100	250	CHILLED WATER PUMP BYPASS VALVE
CV-8A	NELES	*2	STEAM	532.0	30.0	15.0	34.5	8.4	1"	45.0	0.4	0.8	60.2	75	30	30	150	1/3 VALVE FOR 1/2 OF AHU-1 PREHEAT COILS
CV-8B	NELES	*2	STEAM	532.0	30.0	15.0	34.5	8.4	1"	45.0	0.4	0.8	60.2	75	30	30	150	1/3 VALVE FOR 1/2 OF AHU-1 PREHEAT COILS
CV-9A	NELES	*2	STEAM	1064.0	30.0	15.0	34.5	16.8	1.5"	110.0	0.2	0.5	49.7	75	30	30	150	2/3 VALVE FOR 1/2 OF AHU-1 PREHEAT COILS
CV-9B	NELES	*2	STEAM	1064.0	30.0	15.0	34.5	16.8	1.5"	110.0	0.2	0.5	49.7	75	30	30	150	2/3 VALVE FOR 1/2 OF AHU-1 PREHEAT COILS
CV-10A	NELES	*2	CHILLED WATER	175.0	---	4.3	10.0	83.9	2"	180.0	0.9	2.2	87.3	75	100	100	250	CHILLED WATER VALVE FOR 1/2 OF AHU-1
CV-10B	NELES	*2	CHILLED WATER	175.0	---	4.3	10.0	83.9	2"	180.0	0.9	2.2	87.3	75	100	100	250	CHILLED WATER VALVE FOR 1/2 OF AHU-1
CV-11	NELES	*2	STEAM	276.0	30.0	15.0	34.5	4.4	1"	15.0	0.9	2.0	61.5	75	30	30	150	1/3 VALVE FOR AHU-3 PREHEAT COILS
CV-12	NELES	*2	STEAM	552.0	30.0	15.0	34.5	8.7	1"	45.0	0.4	0.9	61.7	75	30	30	150	2/3 VALVE FOR AHU-3 PREHEAT COILS
CV-13	NELES	*2	CHILLED WATER	71.0	---	4.3	10.0	34.1	1.5"	110.0	0.4	1.0	73.0	75	100	100	250	CHILLED WATER VALVE FOR AHU-3
CV-14A	NELES	*2	STEAM	532.0	30.0	15.0	34.5	8.4	1"	45.0	0.4	0.8	60.2	75	30	30	150	1/3 VALVE FOR 1/2 OF AHU-2 PREHEAT COILS
CV-14B	NELES	*2	STEAM	532.0	30.0	15.0	34.5	8.4	1"	45.0	0.4	0.8	60.2	75	30	30	150	1/3 VALVE FOR 1/2 OF AHU-2 PREHEAT COILS
CV-15A	NELES	*2	STEAM	1064.0	30.0	15.0	34.5	16.8	1.5"	110.0	0.2	0.5	49.7	75	30	30	150	2/3 VALVE FOR 1/2 OF AHU-2 PREHEAT COILS
CV-15B	NELES	*2	STEAM	1064.0	30.0	15.0	34.5	16.8	1.5"	110.0	0.2	0.5	49.7	75	30	30	150	2/3 VALVE FOR 1/2 OF AHU-2 PREHEAT COILS
CV-16A	NELES	*2	CHILLED WATER	175.0	---	4.3	10.0	83.9	2"	180.0	0.9	2.2	87.3	75	100	100	250	CHILLED WATER VALVE FOR 1/2 OF AHU-2
CV-16B	NELES	*2	CHILLED WATER	175.0	---	4.3	10.0	83.9	2"	180.0	0.9	2.2	87.3	75	100	100	250	CHILLED WATER VALVE FOR 1/2 OF AHU-2
CV-17	NELES	*2	STEAM	276.0	30.0	15.0	34.5	4.4	1"	15.0	0.9	2.0	61.5	75	30	30	150	1/3 VALVE FOR AHU-4 PREHEAT COILS
CV-18	NELES	*2	STEAM	552.0	30.0	15.0	34.5	8.7	1"	45.0	0.4	0.9	61.7	75	30	30	150	2/3 VALVE FOR AHU-4 PREHEAT COILS
CV-19	NELES	*2	CHILLED WATER	71.0	---	4.3	10.0	34.1	1.5"	110.0	0.4	1.0	73.0	75	100	100	250	CHILLED WATER VALVE FOR AHU-4

REMARKS:

1. BALL VALVE.
2. ROTARY, SEGMENT/V-PORT, RE. PROVIDE WITH ELECTRIC ACTUATOR. ACTUATOR TO BE CAPABLE OF DRIVING TO N.C. POSITION ON LOSS OF POWER.
3. USE ON VAV REHEAT AND FAN COIL UNIT COILS WITH FLOWS IN RANGES SCHEDULED. SEE PLANS FOR ACTUAL FLOWS. USE 3-WAY VALVES WHERE INDICATED ON DRAWINGS.
4. PROVIDE CHILLED WATER VALVES RATED FOR 250 PSI WOG.
5. ALL REHEAT VALVES FOR TERMINAL HEATING ARE TO BE BALL TYPE VALVES WITH UPPER THRUST BEARING AND RESILIENT SEAT. THE VALVE IS TO BE RATED FOR 300°F MAX TEMPERATURE AND 175 PSIG MAX PRESSURE WITH A CARBON STEEL BODY AND STAINLESS STEEL BALL. THE VALVES ARE TO BE EQUIPPED WITH AN ELECTRIC MODULATING ACTUATOR IN ALL CASES. ACTUATORS OR OUTPUT TRANSDUCERS SHALL ACCEPT PROPORTIONAL MILLIAMP, MILLIVOLT OR VOLTAGE. USE OF FLOATING OR INCREMENTAL OPEN LOOP CONTROL ACTUATORS THAT DO NOT PROVIDE POSITIVE POSITION FEEDBACK TO THE DDC CONTROLLER SHALL BE UNACCEPTABLE.

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NOT FOR CONSTRUCTION

HVAC SCHEDULES

IMPROVE MEMORIAL COLISEUM
FOR:
THE UNIVERSITY OF KENTUCKY
LEXINGTON, KENTUCKY

Architect of Record:
Civil Engineer:
Landscape Architect:
RossTarrant Architects, Inc.
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Signature Sports Architect:
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Structural Engineer of Record:
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MEP Engineer:
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UK# 2520.0
Project No: 1924
Drawn By: AL
Rev'd By: CK
ISSUED FOR:

REVISIONS

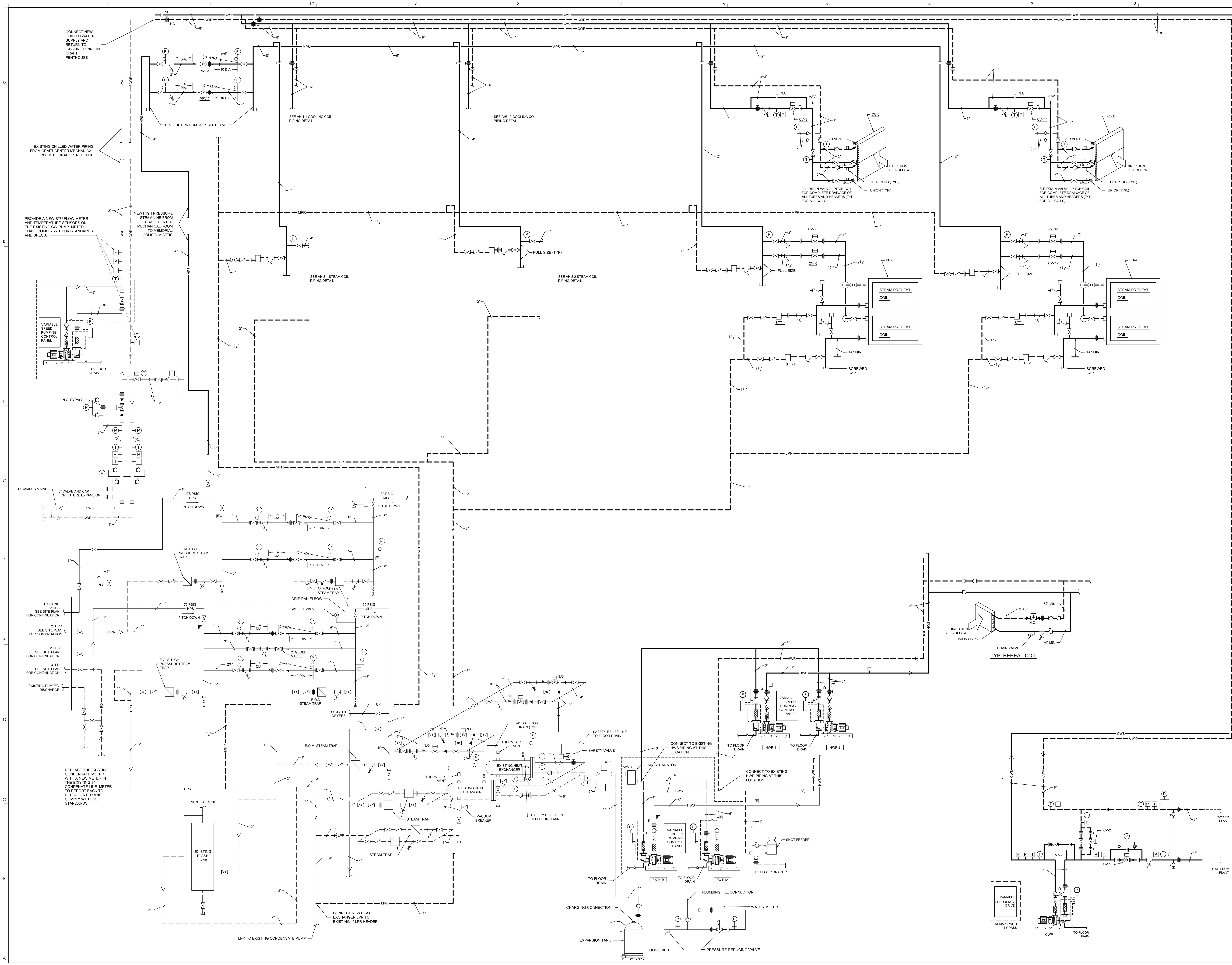
#	DATE	DESCRIPTION

CONSTRUCTION DOCUMENTS

H500

HVAC SCHEDULES

DATE ISSUED:
MARCH 26, 2021



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STAGGS & FISHER CONSULTING ENGINEERS, INC.

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HVAC FLOW DIAGRAM

IMPROVE MEMORIAL COLISEUM
FOR:
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LEXINGTON, KENTUCKY

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H600

HVAC FLOW DIAGRAM

DATE ISSUED:
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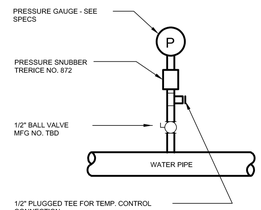
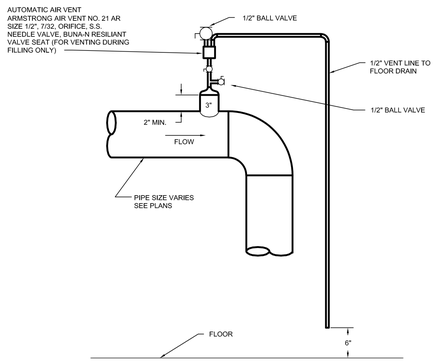
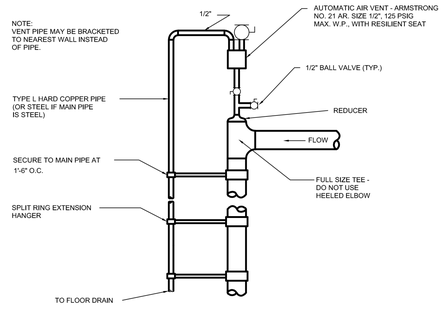


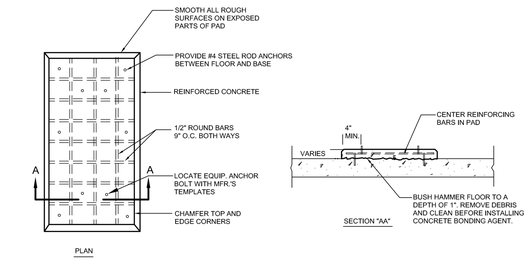
WATER PRESSURE GAUGE INSTALLATION
NO SCALE



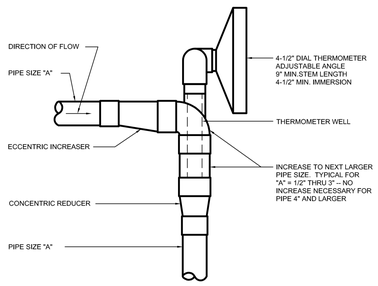
AUTOMATIC AIR VENT DETAILS - 4" & LARGER
NO SCALE



AUTOMATIC AIR VENT DETAILS - 3" & SMALLER
NO SCALE



CONCRETE PAD DETAIL
NO SCALE



PIPE THERMOMETER INSTALLATION DETAIL
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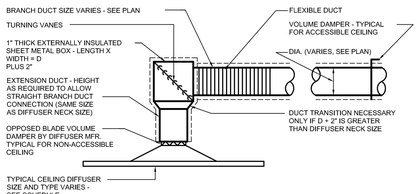
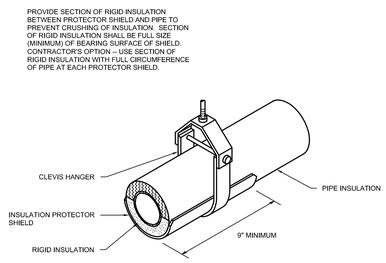
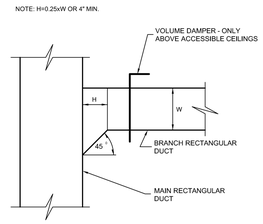


CONNECTION TO S.A. CEILING DIFFUSER
NO SCALE



TYP. PIPE SUPPORT DETAIL WITH SHIELD
NO SCALE



TYPICAL LOW PRESSURE RECTANGULAR DUCT TAKE-OFF
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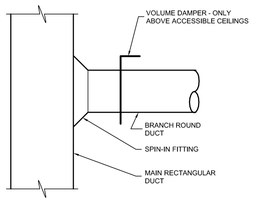

TYPICAL LOW PRESSURE ROUND DUCT TAKE-OFF
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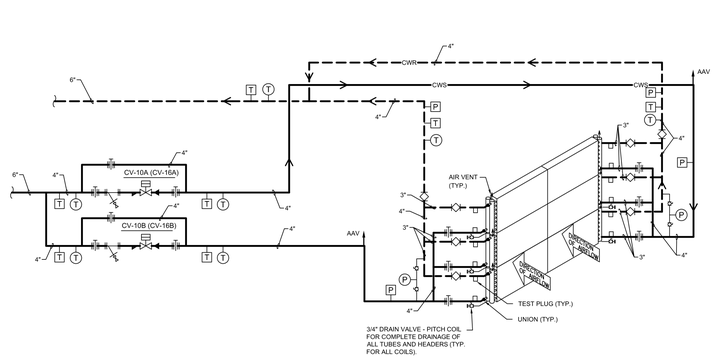
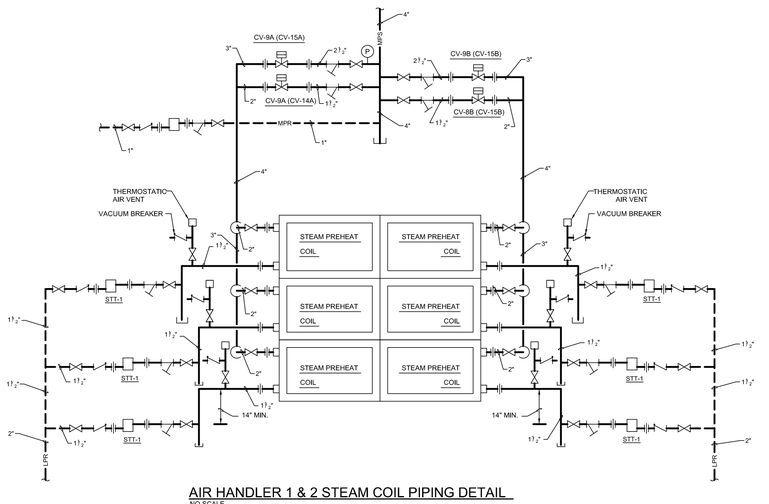
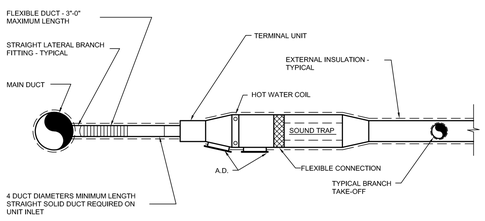


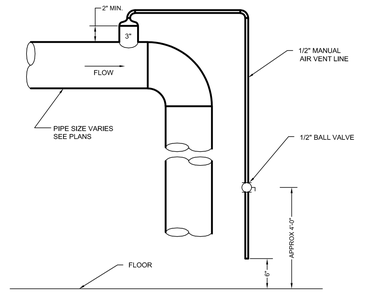
AIR HANDLER 1 & 2 COOLING COIL PIPING DETAIL
NO SCALE



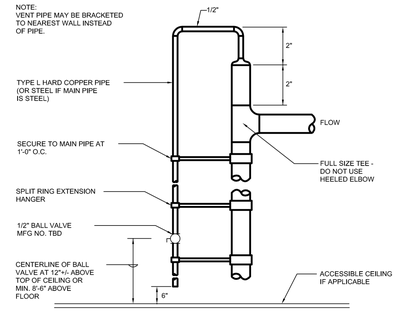
AIR HANDLER 1 & 2 STEAM COIL PIPING DETAIL
NO SCALE



TERMINAL REHEAT UNIT INSTALLATION DETAIL
NO SCALE



MANUAL AIR VENT DETAIL - PIPES 4" AND LARGER
NO SCALE



MANUAL AIR VENT DETAIL - PIPES 3" AND SMALLER
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HVAC DETAILS

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CONSTRUCTION DOCUMENTS

H611

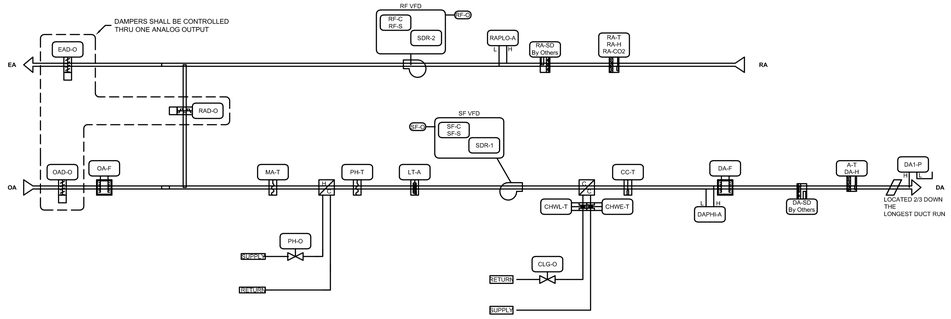
HVAC DETAILS

DATE ISSUED:
MARCH 26, 2021

AHU3 SYSTEM POINTS LIST (AHU4 SIMILAR)						
Type	**Point**	**Description**	**Units**	**Trend**	**Alarm**	**Totalize**
UI IN1	MEMCOL_ATTIC_SOUTH_AHU3_OA-T	Mixed Air Temperature	Deg F	X		
UI IN2	MEMCOL_ATTIC_SOUTH_AHU3_DA-P	Mixed Air Temperature	Deg F	X		
UI IN3	MEMCOL_ATTIC_SOUTH_AHU3_RA-H	Mixed Air Temperature	Deg F	X		
UI IN4	MEMCOL_ATTIC_SOUTH_AHU3_DA-VP	Mixed Air Temperature	Deg F	X		
UI IN5	MEMCOL_ATTIC_SOUTH_AHU3_PH-T	Mixed Air Temperature	Deg F	X		
BI IN6	MEMCOL_ATTIC_SOUTH_AHU3_SF-S	Mixed Air Temperature	Deg F	X		
BI IN7	MEMCOL_ATTIC_SOUTH_AHU3_RF-S	Mixed Air Temperature	Deg F	X		
NET STAT						
BO OUT1	MEMCOL_ATTIC_SOUTH_AHU3_SF-C	Mixed Air Damper Output	%	X		
BO OUT2	MEMCOL_ATTIC_SOUTH_AHU3_RF-C	Mixed Air Damper Output	%	X		
BO OUT3						
CO OUT4	MEMCOL_ATTIC_SOUTH_AHU3_RF-O	Mixed Air Damper Output	%	X		
CO OUT5	MEMCOL_ATTIC_SOUTH_AHU3_CLG-O	Mixed Air Damper Output	%	X		
CO OUT6	MEMCOL_ATTIC_SOUTH_AHU3_HUM-O	Mixed Air Damper Output	%	X		
CO OUT7	MEMCOL_ATTIC_SOUTH_AHU3_PH-O	Mixed Air Damper Output	%	X		
AO OUT8	MEMCOL_ATTIC_SOUTH_AHU3_MAD-O	Mixed Air Damper Output	%	X		
AO OUT9	MEMCOL_ATTIC_SOUTH_AHU3_SF-O	Mixed Air Damper Output	%	X		
UI IN2	MEMCOL_ATTIC_SOUTH_AHU3_RA-VP	Mixed Air Temperature	Deg F	X		
UO OUT4						
UO OUT5						
Software AO	MEMCOL_ATTIC_SOUTH_AHU3_DAT-SP	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_SOUTH_AHU3_DAP-SP	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_SOUTH_AHU3_HTGUNOCC-SP	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_SOUTH_AHU3_CLGUNOCC-SP	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_SOUTH_AHU3_OAD-MINPOS	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_SOUTH_AHU3_ECON-EN	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_SOUTH_AHU3_FLOW-DIFF	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_SOUTH_AHU3_PH-EN	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_SOUTH_AHU3_CLG-EN	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_SOUTH_AHU3_HUM-EN	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_SOUTH_AHU3_DA-F	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_SOUTH_AHU3_RA-F	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_SOUTH_AHU3_OCC-SCHEDULE	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_SOUTH_AHU3_UNITEN-MODE	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_SOUTH_AHU3_APP-MODE	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_SOUTH_AHU3_OA-T	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_SOUTH_AHU3_ZN-T	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_SOUTH_AHU3_HUM-SP	Mixed Air Temperature Setpoint	Deg F	X		

Items below are for reference only

Universal Inputs (UI)
Voltage (0-10V)
Current (4-20mA)
Resistance (0-2000)
Resistive Nickel
Resistive Platinum
Resistive Silicon
Resistive Thermistor 10K NTC Type L or Type 2
Resistive Thermistor 2.25K NTC Type 2
Dry Contact Maintained
Binary Inputs (BI)
Dry Contact Maintained
Dry Contact Pulsed
Analog Outputs (AO)
Voltage (0-10V)
Current (4-20mA)
Binary Outputs (BO)
24 VAC Triac @ .5A
Universal Outputs (UO)
24 VAC Triac @ .5A
Voltage (0-10V)
Current (4-20mA)
Configurable Outputs (CO)
24 VAC Triac @ .5A
Voltage (0-10V)
Relay Output (RO)
120VAC-480VAC



AIR HANDLING UNIT SEQUENCE (AHU3 AND 4) - EVENT LEVEL (UNITS ARE IN THE ATTIC, TYP OF 2)

SUPPLY FAN CONTROL:
THE VARIABLE SPEED SUPPLY FAN (SF-C) WILL BE STARTED BASED ON OCCUPANCY SCHEDULE (OCC-SCHEDULE). WHEN THE SUPPLY FAN STATUS (SF-S) INDICATES THE FAN STARTED, THE CONTROL SEQUENCE WILL BE ENABLED. THE SUPPLY FAN (SF-O) WILL MODULATE TO MAINTAIN THE DISCHARGE STATIC PRESSURE (DA-P) AT SETPOINT (DAP-SP). UPON A LOSS OF AIRFLOW (SF-S), THE SYSTEM WILL SEND ALARM TO DELTA CENTER. PROVIDE RUN INDICATION ON EACH FAN IN "FAN WALL" ASSEMBLY AND ALARM ON FAILURE.

DISCHARGE STATIC PRESSURE SETPOINT:
THE DISCHARGE STATIC PRESSURE SETPOINT SHALL BE ADJUSTED UP AND AND DOWN BASED ON THE DAMPER POSITION OF THE WORST BOX 95% OPEN (ADJ). TROUBLE ROOMS SHALL BE ABLE TO BE EXCLUDED FROM THE LIST OF BOXES CHECKED.

TRETURN FAN CONTROL:
AFTER THE SUPPLY FAN HAS BEEN STARTED, THE VARIABLE SPEED RETURN FAN WILL BE STARTED. THE RETURN FAN (RF-O) WILL MODULATE IN CONJUNCTION WITH THE SUPPLY FAN. THE RETURN FAN WILL OFFSET THE SUPPLY FAN BASED ON REQUIRED OUTSIDE AIRFLOW CFM.

ECONOMIZER CONTROL:
WHEN ENABLED VIA THE NETWORK COMMAND (ECON-ENA), THE ECONOMIZER WILL ACT AS THE INITIAL STAGE OF COOLING, WORKING IN SEQUENCE WITH THE COOLING COIL.

GLOBAL OUTDOOR AIR SENSOR:
THE SYSTEM SHALL USE THE UK GLOBAL OUTDOOR AIR SENSOR AS THE PRIMARY TEMPERATURE READING. IF THE SENSOR FAILS OR IF COMMUNICATION IS LOST, THE LOCAL SENSOR SHALL BE USED AS A BACKUP.

CO2 CONTROL:
CO2 SENSOR SHALL CONTROL THE OUTSIDE AIR TO MAINTAIN THE RETURN AIR CO2 LEVEL TO A MAXIMUM OF 700 PPM (ADJ.) ABOVE THE AMBIENT LEVEL. OUTSIDE AIR SHALL MODULATE FROM MINIMUM CFM (750 CFM ADJ.) TO A MAXIMUM CFM (2,000 CFM ADJ.). THIS SHALL BE CAPABLE OF BEING DISABLED AND THE OUTSIDE AIR CFM SET TO A USER DEFINED NUMBER.

MINIMUM OA CONTROL:
MINIMUM OUTSIDE AIR SHALL MONITORED WITH AN AIRFLOW MONITORING STATION. THE OA DAMPER (OAD-O) WILL OPEN AND CLOSE AS REQUIRED TO MAINTAIN THE MINIMUM OA FLOW SETPOINT. THE FRESH AIR INTAKE OF THE UNIT WILL BE LIMITED TO PREVENT THE MIXED AIR TEMPERATURE (MA-T) FROM FALLING BELOW THE LOW LIMIT SETPOINT (OALT-SP), INITIALLY SET AT 45DEGF (ADJ.).

DISCHARGE TEMPERATURE CONTROL:
THE UNIT WILL CONTROL TO MAINTAIN THE DISCHARGE AIR TEMPERATURE (DA-T) AT THE EFFECTIVE SETPOINT (EFFDAT-SP). THE EFFECTIVE SETPOINT SHALL BE PROPORTIONALLY RESET FROM 55DEGF (ADJ.) TO 65DEGF (ADJ.) BASED ON A ZONE TEMPERATURE AVERAGE OF ALL ZONES SERVED BY THE UNIT & UKS IDEAL ZONE SETPOINT, INITIALLY SET AT 72DEGF (ADJ.). THE PROPORTIONAL RESET SHALL BE AS FOLLOWS; WHEN THE AVERAGE ZONE TEMPERATURE IS 76DEGF (ADJ.), THE EFFECTIVE DISCHARGE AIR SETPOINT SHALL BE 62 DEGF (ADJ.). WHEN THE AVERAGE ZONE TEMPERATURE IS 68DEGF (ADJ.), THE EFFECTIVE DISCHARGE AIR SETPOINT SHALL BE 55DEGF (ADJ.).

OCCUPIED MODE:
THE OCCUPANCY MODE WILL BE CONTROLLED VIA A NETWORK INPUT (OCC-SCHEDULE). THE OCCUPANCY MODE CAN ALSO BE OVERRIDDEN BY A NETWORK INPUT (OCC-OVERRIDE).

UNOCCUPIED MODE:
THE UNIT WILL CYCLE TO MAINTAIN UNOCCUPIED ZONE SETPOINTS (CLGUNOCC-SP & HTGUNOCC-SP) DURING UNOCCUPIED PERIODS. WHEN 10 ZONES (ADJ.) HAVE BEEN OCCUPIED FOR 10 MINUTES (ADJ.) THE AIR HANDLING UNIT WILL BE DRIVEN TO OCCUPIED MODE.

PREHEAT COIL:
THE PREHEAT COIL VALVE SIGNAL (PH-O) WILL MODULATE TO MAINTAIN THE TEMPERATURE SETPOINT AS PART OF THE DISCHARGE TEMPERATURE CONTROL STRATEGY. UPON A DROP IN THE OUTDOOR AIR TEMPERATURE (OA-T) BELOW THE LOW OUTDOOR AIR TEMPERATURE SETPOINT (OALT-SP), WHEN THE UNIT IS SHUTDOWN, THE PREHEAT COIL WILL BE COMMANDED TO A PRESET POSITION, INITIALLY SET AT 0%(ADJ.). UPON A LOSS OF AIRFLOW (SF-S), THE PREHEAT COIL WILL BE COMMANDED TO A PRESET POSITION, INITIALLY SET AT 0% (ADJ.). UPON AN ALARM FROM THE LOW TEMPERATURE ALARM SENSOR (LT-A), WHETHER THE UNIT IS RUNNING OR NOT, THE PREHEAT COIL WILL MODULATE TO MAINTAIN THE PREHEAT TEMPERATURE (PH-T) AT 55 DEGF (ADJ.).

COOLING COIL:
THE COOLING COIL VALVE SIGNAL (CLG-O) WILL MODULATE TO MAINTAIN THE TEMPERATURE SETPOINT AS PART OF THE DISCHARGE TEMPERATURE CONTROL STRATEGY. WHEN THE UNIT IS SHUTDOWN, THE COOLING COIL WILL BE COMMANDED TO A PRESET POSITION, INITIALLY SET AT 0%(ADJ.).

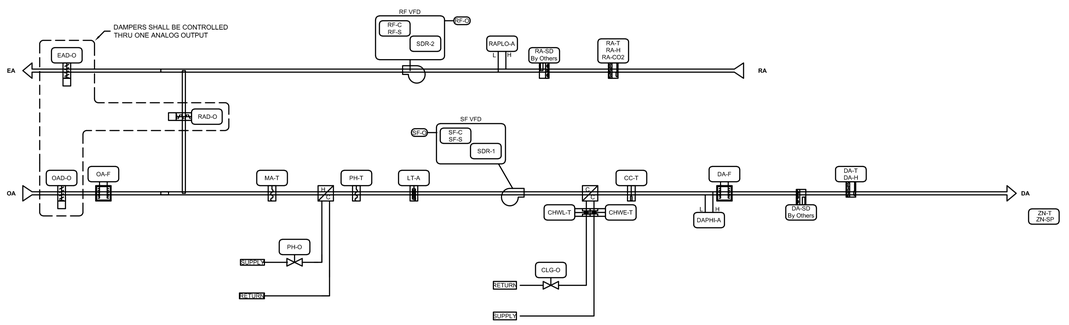
DEHUMIDIFICATION:
ON A RISE IN THE RETURN AIR HUMIDITY (RA-H), THE COOLING COIL DISCHARGE TEMPERATURE SHALL BE SET TO 55 DEGF (ADJ) TO DRIVE THE RETURN AIR HUMIDITY BELOW THE RETURN AIR DEHUMIDIFICATION SETPOINT (DEHUM-SP). THE REHEAT CONTROL WILL MAINTAIN THE TEMPERATURE AT SETPOINT.

UNIT ENABLE:
A NETWORK UNIT ENABLE SIGNAL (UNITEN-MODE) WILL CONTROL THE MODE OF THE UNIT.

UNIT PROTECTION:
- LOW TEMPERATURE ALARM (LT-A) - WHEN IN "ALARM", THE CONTROL SEQUENCE WILL STOP RUNNING, THE VALVE(S) WILL OPEN AND THE FAN(S) WILL BE DISABLED VIA A HARD WIRED SHUTDOWN CIRCUIT.
- DISCHARGE AIR HIGH DUCT PRESSURE ALARM (DAPHI-A) - WHEN IN "ALARM", THE CONTROL SEQUENCE WILL STOP RUNNING AND THE FAN(S) WILL BE DISABLED VIA A HARD WIRED SHUTDOWN CIRCUIT.
- RETURN AIR LOW DUCT PRESSURE ALARM (RAPLO-A) - WHEN IN "ALARM", THE CONTROL SEQUENCE WILL STOP RUNNING AND THE FAN(S) WILL BE DISABLED VIA A HARD WIRED SHUTDOWN CIRCUIT.
- DISCHARGE AIR SMOKE DETECTOR (DA-SD) - DISABLES THE FAN(S) VIA A HARD WIRED SHUTDOWN CIRCUIT.
- RETURN AIR SMOKE DETECTOR (RA-SD) - DISABLES THE FAN(S) VIA A HARD WIRED SHUTDOWN CIRCUIT.

AHU-3 AND 4 OPERATION		
ITEM	ON CYCLE	OFF CYCLE
PRIMARY AIR FAN	ON	OFF
FAN VAR. FREQ. DRIVE	ON	OFF
RETURN AIR FAN	ON	OFF
FAN VAR. FREQ. DRIVE	ON	OFF
MINIMUM O.A. DAMPER	OPEN	CLOSED
MAXIMUM O.A. DAMPER	OPERATING	CLOSED
RETURN AIR DAMPER	OPERATING	OPEN
EXHAUST DAMPER	OPERATING	CLOSED
COOLING COIL VALVE	CONTROLLED	CLOSED
PREHEAT COIL VALVE	CONTROLLED	CONTROLLED

AHU1 AND 2 SYSTEM POINTS LIST						
Type	**Point**	**Description**	**Units**	**Trend**	**Alarm**	**Totalize**
UI IN1	MEMCOL_ATTIC_NORTH_AHU1_DA-T (HC)	Reheat Coil Discharge Air Temperature	Deg F	X		
NET STAT	MEMCOL_ATTIC_NORTH_AHU1_ZN-T/WC-ADJ	#N/A	#N/A	#N/A	#N/A	#N/A
AO OUT1	MEMCOL_ATTIC_NORTH_AHU1_HTG-O	Heating Control Output	%	X		
AO OUT1	HTG-O	Reheat Coil Heating Output	%	X		
BO OUT3	MEMCOL_ATTIC_NORTH_AHU1_CF-O	Ceiling Fan Output	Off On	X		
CO OUT4						
CO OUT5						
Software AO	MEMCOL_ATTIC_NORTH_AHU1_SA-F	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_NORTH_AHU1_DPR-O	Variable Frequency Drive Output	Deg F	X		
Software AO	MEMCOL_ATTIC_NORTH_AHU1_SAFLOW-SP	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_NORTH_AHU1_HTG-EN	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_NORTH_AHU1_ZNT-SP	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_NORTH_AHU1_EFFCLG-SP	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_NORTH_AHU1_EFFHTG-SP	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_NORTH_AHU1_SYSTEM-MODE	Mixed Air Temperature Setpoint	Deg F	X		
Software AO	MEMCOL_ATTIC_NORTH_AHU1_UNITEN-MODE	Mixed Air Temperature Setpoint	Deg F	X		



AIR HANDLING UNIT SEQUENCE (AHU1 AND 2) - COURT (TYP OF 2)

SUPPLY FAN CONTROL:
THE VARIABLE SPEED SUPPLY FAN (SF-C) WILL BE STARTED BASED ON OCCUPANCY SCHEDULE (OCC-SCHEDULE). WHEN THE SUPPLY FAN STATUS (SF-S) INDICATES THE FAN STARTED, THE CONTROL SEQUENCE WILL BE ENABLED. UPON A LOSS OF AIRFLOW (SF-S), THE SYSTEM WILL SEND ALARM TO DELTA CENTER. PROVIDE RUN INDICATION ON EACH FAN IN "FAN WALL" ASSEMBLY AND ALARM ON FAILURE.

THE SUPPLY FAN SHALL BE AT ITS MINIMUM CFM AT STARTUP. ON A CALL FOR COOLING THE DISCHARGE TEMPERATURE SHALL BE LOWERED UNTIL IT REACHES 55°F. IF ADDITIONAL COOLING IS REQUIRED THE CFM SHALL INCREASE (WHILE MAINTAINING 55°F DISCHARGE) UNTIL IT REACHES MAX. CFM.

ON A CALL FOR HEATING THE DISCHARGE TEMPERATURE SHALL BE RAISED UNTIL IT REACHES 90°F. IF ADDITIONAL HEATING IS REQUIRED THE CFM SHALL INCREASE (WHILE MAINTAINING 90°F DISCHARGE) UNTIL IT REACHES MAX. CFM.

RETURN FAN CONTROL:
AFTER THE SUPPLY FAN HAS BEEN STARTED, THE VARIABLE SPEED RETURN FAN WILL BE STARTED. THE RETURN FAN (RF-O) WILL MODULATE IN CONJUNCTION WITH THE SUPPLY FAN. THE RETURN FAN WILL OFFSET THE SUPPLY FAN BASED ON REQUIRED OUTSIDE AIRFLOW CFM.

ECONOMIZER CONTROL:
WHEN ENABLED VIA THE NETWORK COMMAND (ECON-ENA), THE ECONOMIZER WILL ACT AS THE INITIAL STAGE OF COOLING, WORKING IN SEQUENCE WITH THE COOLING COIL.

GLOBAL OUTDOOR AIR SENSOR:
THE SYSTEM SHALL USE THE UK GLOBAL OUTDOOR AIR SENSOR AS THE PRIMARY TEMPERATURE READING. IF THE SENSOR FAILS OR IF COMMUNICATION IS LOST, THE LOCAL SENSOR SHALL BE USED AS A BACKUP.

CO2 CONTROL:
CO2 SENSOR SHALL CONTROL THE OUTSIDE AIR TO MAINTAIN THE RETURN AIR CO2 LEVEL TO A MAXIMUM OF 700 PPM (ADJ.) ABOVE THE AMBIENT LEVEL. OUTSIDE AIR SHALL MODULATE FROM MINIMUM CFM (5,000 CFM ADJ.) TO A MAXIMUM CFM (11,460 CFM ADJ.). THIS SHALL BE CAPABLE OF BEING DISABLED AND THE OUTSIDE AIR CFM SET TO A USER DEFINED NUMBER.

MINIMUM OA CONTROL:
MINIMUM OUTSIDE AIR SHALL MONITORED WITH AN AIRFLOW MONITORING STATION. THE OA DAMPER (OAD-O) WILL OPEN AND CLOSE AS REQUIRED TO MAINTAIN THE MINIMUM OA FLOW SETPOINT. THE FRESH AIR INTAKE OF THE UNIT WILL BE LIMITED TO PREVENT THE MIXED AIR TEMPERATURE (MA-T) FROM FALLING BELOW THE LOW LIMIT SETPOINT (OALT-SP), INITIALLY SET AT 45DEGF (ADJ.).

DISCHARGE TEMPERATURE CONTROL:
THE UNIT WILL CONTROL TO MAINTAIN THE DISCHARGE AIR TEMPERATURE (DA-T) AT THE EFFECTIVE SETPOINT (EFFDAT-SP). THE EFFECTIVE SETPOINT SHALL BE PROPORTIONALLY RESET FROM SDEGF (ADJ.) TO 90 DEGF (ADJ.) BASED ON THE SPACE TEMPERATURE. THE TWO AIR HANDLERS DISCHARGE TEMPERATURES SHALL TRACK TOGETHER.

OCCUPIED MODE:
THE OCCUPANCY MODE WILL BE CONTROLLED VIA A NETWORK INPUT (OCC-SCHEDULE). THE OCCUPANCY MODE CAN ALSO BE OVERRIDDEN BY A NETWORK INPUT (OCC-OVERRIDE). ANYTIME THESE FANS ARE OCCUPIED THE 4 "CEILING FANS" SHALL BE ENABLED.

UNOCCUPIED MODE:
THE UNIT WILL CYCLE TO MAINTAIN UNOCCUPIED ZONE SETPOINTS (CLGUNOCC-SP & HTGUNOCC-SP) DURING UNOCCUPIED PERIODS. WHEN 10 ZONES (ADJ.) HAVE BEEN OCCUPIED FOR 10 MINUTES (ADJ.) THE AIR HANDLING UNIT WILL BE DRIVEN TO OCCUPIED MODE.

PREHEAT COIL:
THE PREHEAT COIL VALVE SIGNAL (PH-O) WILL MODULATE TO MAINTAIN THE TEMPERATURE SETPOINT AS PART OF THE DISCHARGE TEMPERATURE CONTROL STRATEGY. UPON A DROP IN THE OUTDOOR AIR TEMPERATURE (OA-T) BELOW THE LOW OUTDOOR AIR TEMPERATURE SETPOINT (OALT-SP), WHEN THE UNIT IS SHUTDOWN, THE PREHEAT COIL WILL BE COMMANDED TO A PRESET POSITION, INITIALLY SET AT 0%(ADJ.). UPON A LOSS OF AIRFLOW (SF-S), THE PREHEAT COIL WILL BE COMMANDED TO A PRESET POSITION, INITIALLY SET AT 0% (ADJ.). UPON AN ALARM FROM THE LOW TEMPERATURE ALARM SENSOR (LT-A), WHETHER THE UNIT IS RUNNING OR NOT, THE PREHEAT COIL SHALL MODULATE TO MAINTAIN THE PREHEAT TEMPERATURE (PH-T) AT 55 DEGF (ADJ.). THE HEATING COOLING AND COOLING COIL SHALL NOT BE ALLOWED TO OPERATE AT THE SAME TIME.

COOLING COIL:
THE COOLING COIL VALVE SIGNAL (CLG-O) WILL MODULATE TO MAINTAIN THE TEMPERATURE SETPOINT AS PART OF THE DISCHARGE TEMPERATURE CONTROL STRATEGY. WHEN THE UNIT IS SHUTDOWN, THE COOLING COIL WILL BE COMMANDED TO A PRESET POSITION, INITIALLY SET AT 0%(ADJ.).

DEHUMIDIFICATION:
ON A RISE IN THE RETURN AIR HUMIDITY (RA-H), THE COOLING COIL DISCHARGE TEMPERATURE SHALL BE SET TO 55 DEGF (ADJ) TO DRIVE THE RETURN AIR HUMIDITY BELOW THE RETURN AIR DEHUMIDIFICATION SETPOINT (DEHUM-SP). THE REHEAT CONTROL WILL MAINTAIN THE TEMPERATURE AT SETPOINT.

UNIT ENABLE:
A NETWORK UNIT ENABLE SIGNAL (UNITEN-MODE) WILL CONTROL THE MODE OF THE UNIT.

UNIT PROTECTION:
- LOW TEMPERATURE ALARM (LT-A) - WHEN IN "ALARM", THE CONTROL SEQUENCE WILL STOP RUNNING, THE VALVE(S) WILL OPEN AND THE FAN(S) WILL BE DISABLED VIA A HARD WIRED SHUTDOWN CIRCUIT.
- DISCHARGE AIR HIGH DUCT PRESSURE ALARM (DAPHI-A) - WHEN IN "ALARM", THE CONTROL SEQUENCE WILL STOP RUNNING AND THE FAN(S) WILL BE DISABLED VIA A HARD WIRED SHUTDOWN CIRCUIT.
- RETURN AIR LOW DUCT PRESSURE ALARM (RAPLO-A) - WHEN IN "ALARM", THE CONTROL SEQUENCE WILL STOP RUNNING AND THE FAN(S) WILL BE DISABLED VIA A HARD WIRED SHUTDOWN CIRCUIT.
- DISCHARGE AIR SMOKE DETECTOR (DA-SD) - DISABLES THE FAN(S) VIA A HARD WIRED SHUTDOWN CIRCUIT.
- RETURN AIR SMOKE DETECTOR (RA-SD) - DISABLES THE FAN(S) VIA A HARD WIRED SHUTDOWN CIRCUIT.

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3264 Loch Ness Drive
Lexington, KY 40517
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NOT FOR CONSTRUCTION

HVAC INSTRUMENTATION & CONTROLS

IMPROVE MEMORIAL COLISEUM
FOR:
THE UNIVERSITY OF KENTUCKY
LEXINGTON, KENTUCKY

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#	DATE	DESCRIPTION

CONSTRUCTION DOCUMENTS

IC700

HVAC INSTRUMENTATION & CONTROLS

DATE ISSUED:
MARCH 26, 2021

Specification Index

Drawing Index

Item No.	Item Rev.	Package No.	Package Rev.	Description	Reference No.
				VFD Warranty	Closeout
				VFD O&M	Closeout

SECTION 23 0950 – VARIABLE FREQUENCY DRIVES FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and General Requirements, Division 1 Specification Sections apply to the work specified in this section.

1.2 DEFINITIONS

A. DDC: Direct digital control.

B. I/O: Input/output.

C. Interlock: When the term "interlock" is used in the control sequence, it shall mean a hardware interlock. Software interlocks are not acceptable.

D. MS/TP: Master slave/token passing.

E. PC: Personal computer.

F. PID: Proportional plus integral plus derivative.

G. RTD: Resistance temperature detector.

1.3 DESCRIPTION OF WORK:

A. VFDs will be owner purchased and contractor installed. Factory startup will be included with the owner furnished drives. Furnish and install and fit-up in complete working order, with all accessories required, the variable frequency drives (VFD) and monitoring of these drives by the temperature control systems shown on the Drawings and specified herein. The systems shall be properly connected, piped and wired in a manner conforming to the laws, ordinances and codes now in force in the Commonwealth of Kentucky.

1.4 QUALITY ASSURANCE:

A. Manufacturers: Select a manufacturer from the following listing. Do not use a manufacturer that is not listed below.

B. Manufacturers: Subject to compliance with requirements, manufacturers offering controls that may be incorporated into the Work include, shall be one of the following:

1. ABB.
2. Allen Bradley
3. Cutler Hammer
4. Yaskawa

C. Codes and Standards:

1. Electrical Standards: Provide electrical components of control systems which have been UL-listed and labeled, and comply with NEMA standards.
2. NFPA Compliance: Comply with NFPA 90A "Standard for the installation of Air Conditioning and Ventilating Systems" where applicable of controls and control sequences.
3. Kentucky Building Code: Comply with requirements where applicable for controls.

1.5 ACTION SUBMITTALS

A. Product Data: For each type and rating of VFD indicated. Include features, performance, electrical ratings, operating characteristics, shipping and operating weights, and furnished specialties and accessories.

B. Shop Drawings: For each VFD indicated. Include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.

1. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Each installed unit's type and details.
b. Factory-installed devices.
c. Enclosure types and details.
d. Nameplate legends.
e. Short-circuit current (withstand) rating of enclosed unit.
f. Features, characteristics, ratings, and factory settings of each VFD and installed devices.
g. Specified modifications.

2. Schematic and Connection Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Product Certificates: For each VFD, from manufacturer.

C. Source quality-control reports.

D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VFDs to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1.8 DELIVERY, STORAGE AND HANDLING:

A. Provide factory shipping cartons for each piece of equipment and control device. Maintain cartons while shipping, storage and handling as required to prevent equipment damage and to eliminate dirt and moisture from equipment. Store equipment and materials inside and protect from weather.

1.9 COORDINATION

A. Coordinate equipment with Division Section "Automatic Temperature Controls" to achieve interfaces with that control system.

PART 2 - PRODUCTS

2.1 VARIABLE FREQUENCY DRIVES:

A. Basic Description:

1. The variable frequency drive (VFD) shall be solid state, with a Pulse Width Modulated (PMW) output waveform (VVI, six-step, and current source drives are not acceptable). The VFD package as specified herein shall be enclosed in a single NEMA **12** enclosure, completely assembled and tested by the manufacturer. The VFD shall employ a full wave rectifier (to prevent input line notching), DC Line Reactor, capacitors, and Insulated Gate Bipolar Transistors (IGBT's) as the output switching device (SCR's, GTO's and Darlington transistors are not acceptable). The drive efficiency shall be 97% or better at full speed and full load. Fundamental power factor shall be 0.98 at all speeds and loads.
2. The VFD shall be specifically designed for variable torque, centrifugal load applications. The Control System Contractor shall perform the following functions from the FMS: remote bypass/auto switching, stop/start, remote speed adjustment, error monitoring and actual speed readout.
3. The VFD shall be suitable for use with any standard NEMA-B squirrel-cage induction motor having a 1.15 or more service factor, or with existing standard NEMA-B squirrel-cage induction motor with nameplate data as shown on the plans. At any time in the future, it shall be possible to substitute any standard motor (equivalent horsepower, voltage and RPM) in the field.
4. Output voltage regulation shall be plus-or-minus 1 per cent from no load to full load.
5. When input speed command is lost, the drive shall continue operation at either last speed command, minimum speed, or a preset speed as determined by the operator.
6. The VFD shall be capable of starting into a spinning load with complete protection and promptly return the motor to set speed. It shall also be capable of bringing windmilling loads to a stop prior to accelerating load in the proper direction by such means as injection braking.
7. All programmable settings, including self diagnostic fault data, shall be held in non-volatile memory and shall not be affected by power outages, brownouts, power dips, etc. The AFD shall have initial programmable settings intact from the factory without the need of battery backup, etc. The start-up technician shall program each AFD to the motor for which it is connected.
8. Programming at the job site to accommodate specific local application requirements, such as frequency avoidance and preset speeds shall be available to the user.
9. Complete efficiency versus load and speed for all VFD ratings shall be readily available from the manufacturer. VFD multiple motor operation at the same frequency and speed shall be possible as long as the sum of the connected motor full load sine wave currents are less than or equal to 90% of the VFD maximum continuous current rating.
10. All high voltage components within the enclosure shall be supplied, protected or enclosed in a method that makes them safe.

B. Codes/Standards:

1. VFD and options shall be UL listed.
2. The controller and options shall comply with the applicable requirement of the latest standards of ANSI; NEMA ICS-6 for controls and systems; National Electric Code NEC; IEC 801-2, 801-4, 256-4.

C. Quality Assurance: The VFD controller shall be subject to but not limited to the following quality assurance controls, procedures and tests.

1. The manufacturer shall have been actively and continuously engaged in the production of adjustable frequency controllers for a period of at least 10 years and have experience of at least 8 years in commercial HVAC applications.
2. Every VFD shall be functionally tested under motor load and must pass a 4-hour minimum heat run under motor load.

Commented [WP1]: A. Referenced Standards and Guidelines:
1. Institute of Electrical and Electronic Engineers (IEEE)
   a. IEEE 519-2014, IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems
2. Underwriters Laboratories (as appropriate)
   a. UL 508A
   b. UL 61800-5-1
3. National Electric Code (NEC)
   a. NEC 430.120, Adjustable-Speed Drive Systems
4. CSA Group
   a. CSA C22.2 No. 274
5. International Building Code (IBC)
   a. IBC 2018 Seismic – referencing ASCE 7-16 and ICC AC-156

D. Variable Frequency Drive:

1. The VFD manufacturer shall provide, at minimum, the electromechanical construction, basic features, adjustments, general options and modifications and special options as outlined in this specification.

E. Basic Features: The VFD shall have the following basic features:

1. Variable Frequency Drive shall be mounted in a NEMA 12 enclosure.
2. The VFD shall incorporate a full 20 character minimum, alpha/numeric customer interface panel showing all settings, parameters, operating screens, operating data, supervision information and faults in plain English. VFD's employing codes and abbreviations shall not be acceptable.
3. Operators controls shall be mounted on the door of the cabinet and consist of a membrane command center which allows manual stop/start and speed control, local/remote indication and manual/or automatic speed control selection. In addition, the command center will serve as a means to configure controller parameters such as minimum speed, maximum speed, acceleration and deceleration times, volts/Hz ratio, torque boost, etc. Potentiometers will not be allowed for these settings.
4. For ease of Owner and TCC use, the VFD shall also incorporate a speed potentiometer for manual speed control and a hand-off-auto selector switch. Membrane/keypad functions can also be utilized to perform these functions.
5. The controller will be able to follow an external speed signal and respond to remote start/stop contacts wired to the terminal strip while in the automatic/remote mode.
6. Disconnect: Door interlocked fused disconnect shall interrupt all input power from the drive and all internally mounted options. The disconnect handle shall be through-the-door type and shall be padlockable in the "OFF" position.
7. The controller shall contain a U.L. electronic overload circuit designed to protect the A-C motor, operated on the adjustable frequency controller output from extended overload operation on an inverse time basis. A motor thermostat back-up may also be provided.
8. The VFD shall also incorporate programmable protection settings for motor stall, motor under-load, and motor at speeds to protect the motor in applications requiring less than full load/full speed motor requirements.
9. The VFD shall have two programmable/selectable analog inputs which will accept current or voltage input signals for speed reference or for manual put reference or for actual feedback signals for use of the VFD built in proportional integral controller. These analog inputs shall be programmable for filtering, gain and offsets. The VFD shall incorporate a loss or analog input circuit which is programmable and can not only send an external output warning (DO), but also determine a preset speed of the VFD for safety purposes.
10. Automatic restarts will be attempted three times after a power outage, drive fault, safety shutdown such as freezestat or firestat, or external fault, if the drive is in automatic mode. The circuit shall allow the user to select 0, 1, 2 or 3 restart attempts as well as select the dwell time between attempts. The reset time between fault occurrences shall also be selectable. All settings shall be via the membrane command center.
11. The following operating information shall be available to be displayed on the VFD's 20 character (minimum) full alphanumeric display:

    a. Output frequency
    b. Output RPM/speed (programmable)
    c. Motor currents
    d. Calculated motor power - calculated
    e. KwHr meter

12. There shall be a minimum of two critical frequency avoidance bands which can be programmed in the field via the membrane command center to enable the controller to avoid certain frequencies which the pump or fan system may resonate at due to reduced speed operation.

Commented [WP2]: Obviously job specific

Commented [WP3]: Yaskawa uses fault codes that have to be referenced to a manual

Commented [WP4]: Restart on ABB is selectable up to 5 times, and you can apply it to individual faults

13. There shall be seven programmable preset speeds which will force the VFD to a preset speed upon a user contact closures. This feature shall be set digitally by entering via the door mounted membrane command center.
14. Disconnecting the motor for free wheeling operation in periods of power outage is not acceptable.
15. To prevent unnecessary trips, include a speed droop feature which reduces the speed of the drive on transient overload. The drive is to return to the set speed after the transient is removed. Should the acceleration or deceleration rates be too rapid for the moment of inertia of the load, the drive is to automatically compensate to prevent drive trip.

    a. Voltage dip ride through: The VFD shall be capable of sustaining operation with a 30% dip in nominal line voltage. Output speed may decline only if current limit rating of the VFD is exceeded.
    b. Power loss ride through: The VFD shall be capable of a 5 cycle power loss ride through without fault activation.

16. Compliance to IEEE 519 -- Harmonic analysis for particular jobsite including total voltage harmonic distortion and total current distortion.

F. Manufacturer shall perform and submit calculations, specific to this project, which show that the theoretical line notching and voltage distortion comply with IEEE-519, Special Applications Criteria (10% notching, 3% distortion). If line notching and/or voltage distortion exceed these values, then provide equipment to provide this level of filtration. Obtain information for sizing line filtering equipment (such as transformer sizes and impedances, feeder sizes, capacitor locations, etc.) from Electrical Plans or from General Contractor/Electrical Contractor.

G. Protective Circuits and Features: The VFD shall include the following protective circuits and features:

1. Fast acting semiconductor fuses specifically sized for protection of the AFC.
2. DV/DT and DI/DT protection for semiconductors.
3. Instantaneous Electronic Trip for the following faults:

    a. Motor current exceeds 110% for longer than one minute of controller maximum sine wave current rating
    b. Output phase-to-phase circuit condition
    c. Total ground fault under any operating condition
    d. High input line voltage
    e. Low input line voltage

H. The VFD shall have the following protection circuits and display on the 20 character alphanumeric display the appropriate faults. Fault notification must be in plain English. Fault codes are not acceptable.

1. Overcurrent trip device – to continuously monitor peak currents and provide instantaneous shutdown without component failure when the high limit is surpassed.
2. Over-voltage trip -- selectable to protect motor AFC
3. Under-voltage trip -- 65% of AFC rating
4. Ground fault -- Running on start at motor
5. Motor overload - I^2T -- UL-NEC-overload
6. Motor under-load trip -- warning or fault
7. VFD overtrip -- Over heat sink limits

I. Three “last faults” shall be kept in non-voltage memory for ease of troubleshooting.

1. Metal oxide varistors.

J. Adjustments: The following adjustments shall be followed:

Commented [WP5]: B. The drive shall provide full rated output from a line of +10% to -15% of nominal voltage across an ambient temperature range of -15 to 40° C (5 to 104° F).

4. The base drive shall be SEMI-F47 certified. The drive must tolerate voltage sags to 50% for up to 0.2 seconds, sags to 70% for up to 0.5 seconds, and sags to 80% for up to one second.

Commented [WP6]: Harmonic analysis can be done but is job by job and not the default

Commented [WP7]: 1. A Fault Logger that stores the last 16 faults in non-volatile memory. The most recent 5 faults save at least 9 data points, including but not limited to: Time/date, frequency, DC bus voltage, motor current, DI status, temperature, and status words.
2. An Event Logger that stores the last 16 warnings or events that occurred, in non-volatile memory. Events shall include, but not limited to: Warning messages, checksum mismatch, run permissive open, start interlock open, and automatic reset of a fault, power applied, auto start command, auto stop command, modulating started, and modulating stopped.

1. Maximum frequency (0 to 120 Hz) with factory setting at 60 Hz.
2. Minimum frequency (0 to 60 Hz) with factory setting at 6 Hz.
3. Acceleration (2 to 3200 seconds) factory set at 60 seconds.
4. Deceleration (2 to 3200 seconds) factory set at 60 seconds.
5. Adjustable U/Hz, U/Hz^2 and automatic H/Hz$^{(2)}$ setting for energy savings.
6. Voltage offset or boost with factory setting at 100% torque.
7. Current limit (50 to 100%) sine wave current rating factory set at 100%.

K. Service Conditions: The VFD shall be designed and constructed to operate within the following service conditions:

1. Suitable for continuous operation at an ambient temperature of 0ºC. to 40ºC. Elevation up to 3300 feet altitude with a relative humidity to 95% non-condensing.
2. A-C line variation of 440 vac +10% -5% frequency.

L. Electronic Bypass:

1. Provide U.L. Listed microprocessor based bypass controller for each variable frequency drive, for manual or automatic transfer to line power via contactors. Provide means of limiting speed to specified value when drive is manually switched to bypass (when system is operating on emergency power). Coordinate with Automatic Control System Supplier.
2. Provide a keypad to control the bypass controller mounted on the enclosure door. The bypass keypad shall include a one line diagram and status LED's to indicate the mode of operation, drive and bypass status and ready and enable conditions. When in the "Drive" mode, the bypass contactor is open and the drive output contactor is closed. In the "Bypass" position, the drive output contactor is open and the bypass contractor is closed via Start/stop command.
    a. Provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. External safety interlocks shall remain fully functional whether the system is in Hand, Auto, Drive or Bypass modes.
    b. Automatic/manual bypass operation shall be selectable in the standard microprocessor based bypass design.
    c. Provide a door/cover interlocked disconnect switch to disconnect all input power from the drive, bypass and all internally mounted options. The disconnect handle shall be through the door, and be pad-lockable in the "Off" position.
    d. Provide fast acting semi-conductor fuses exclusive to the VFD – to disconnect from the line prior to clearing upstream branch circuit protection.
    e. Provide Class 20 or 30 electronic motor overload protection in the microprocessor bypass to protect the motor in bypass mode.

M. BACnet Board

1. Provide BACnet board to allow communications to communicate on BACnet networks.

N. Installation:

1. Installation shall be the responsibility of the Mechanical Contractor. The Contractor shall install the drive in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.
2. Power wiring shall be completed by the Electrical Contractor. The Contractor shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.
3. This Contractor shall be responsible for interlock with remote disc.

O. Start-Up:

Commented [WP8]: B. The drive shall provide full rated output from a line of +10% to -15% of nominal voltage across an ambient temperature range of -15 to 40° C (5 to 104° F).

Commented [WP9]: 5. All bypasses shall have the following hardware features/characteristics as standard:
a. Six (6) digital inputs and five (5) Form-C relay outputs.
b. Drive isolation fuses shall be provided. Bypass designs which have no such fuses, or that only incorporate fuses common to both the drive and the bypass are not acceptable.
c. The bypass shall be able to detect a single-phase input power condition while running in bypass, disengage the motor, and provide a single-phase input power indication.
d. The bypass shall be designed for stand-alone operation and be completely functional in both Hand and Automatic modes, even if the drive and/or drive's control board has failed.

1. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the Owner, and a copy kept on file at the manufacturer.

P. Electrical Power -- Three phase, 60 cycle, 460 volts.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF VFD

A. General: Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on the Drawings.

B. Connect and configure equipment and software to achieve sequence of operation specified.

3.3 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 each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
4. Test each system for compliance with sequence of operation.
5. Test software and hardware interlocks.

3.4 ADJUSTING:

A. This Contractor shall work with the Balancing Contractor to provide verification of CFM, current, voltage, RPM for each VFD.

3.5 CLEANING

A. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum cabinet.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner”s maintenance personnel to adjust, operate, and maintain VFD.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
2. Review data in maintenance manuals.
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

COOLING COIL

SYMBOL	MANUFACTURER	MODEL	ROWS	F.P.I.	MAX CFM	VEL. FPM	A.P.D.IN W.G.	ENTERING AIR D.B.	ENTERING AIR W.B.	LEAVING AIR D.B.	LEAVING AIR W.B.	GPM	E.W.T.	P.D. IN FT.	DIMEN. HxW	REMARKS
CC-1	CLIMATE CRAFT	58WC45X087-08-10-AW	8	10	80,000	490	0.82	78	65	51.4	51.2	380	44	16.6	*1	*2
CC-2	CLIMATE CRAFT	58WC45X087-08-10-AW	8	10	80,000	490	0.82	78	65	51.4	51.2	380	44	16.6	*1	*2
CC-3	CLIMATE CRAFT	58WC36X083-08-09-AW	8	9	20,000	482	0.71	78	65	52.8	52.6	87	44	4.2	*3	*2
CC-4	CLIMATE CRAFT	58WC36X083-08-09-AW	8	9	20,000	482	0.71	78	65	52.8	52.6	87	44	4.2	*3	*2

REMARKS:

*1 6 COILS, EACH AT 45" HIGH, 87" LONG, 3" CONNECTIONS. BOLT OFF TO BE REMOVED THROUGH PLENUM DOOR.

*2 STAINLESS STEEL HEADERS, 0.01" FINS, 0.035" TUBES. PROVIDE WITH MISTOP MIST ELIMINATOR.

*3 2 COILS, EACH AT 36" HIGH, 83" LONG, 3" CONNECTIONS. BOLT OFF TO BE REMOVED THROUGH PLENUM DOOR.

CUSTOM AIR HANDLING UNITS

SYMBOL	MANUFACTURER	MODEL	SIZE	A.C.C.	MAX CFM	MIN. O.A. *4	SUPPLY E.S.P. IN. W.G.	RETURN E.S.P. IN. W.G.	SUPPLY FAN NUMBER	RETURN FAN NUMBER	COOLING COIL NO.	HEATING COIL NO.	FILTER	REMARKS
AHU-1	CLIMATE CRAFT	*1	*2	*3	80,000	11,460	1.0	0.75	SF-1	RF-1	CC-1	PH-1	*5	*6
AHU-2	CLIMATE CRAFT	*1	*2	*3	80,000	11,460	1.0	0.75	SF-2	RF-2	CC-2	PH-2	*5	*6
AHU-3	CLIMATE CRAFT	*1	*7	*8	20,000	2,000	2.75	0.75	SF-3	RF-3	CC-3	PH-3	*9	*10
AHU-4	CLIMATE CRAFT	*1	*7	*8	20,000	2,000	2.75	0.75	SF-4	RF-4	CC-4	PH-4	*9	*10

REMARKS:

*1 CUSTOM KNOCKDOWN. UNIT MUST FIT THROUGH OPENINGS PROVIDED. COORDINATE WITH CONSTRUCTION MANAGER.

*2 PROVIDE IN TWO PIECES. FIRST 549.25" LONG, 159.13" TALL, 207" WIDE. SECOND 193.25" LONG, 159.13" TALL AND 207" WIDE. THE TWO PIECES WILL BE CONNECTED BY THE MECH CONTRACTOR WITH INSULATED SHEET METAL SLEEVED AROUND EXISTING STRUCTURE.

*3 PROVIDE WALKABLE GRATE WITH OSHA HANDRAILS AND TOE STRIP OVER THE TWO SECTIONS. PORTION SHOWN ON PLAN TO HAVE WALKABLE ROOF WITH DIAMOND PLATE SURFACE, OSHA HADRAILS TOE STRIP AND LADDER. UNIT TO BE PROVIDED WITH RETURN SOUND TRAPS, RETURN FANS, MIXING BOX WITH ECONOMIZER, PREFILTERS, SUPPLY FANS, SUPPLY SOUND TRAPS, COOILNG COILS, DISCHARGE PLENUM.

*4 AT FULL OCCUPANCY.

*5 MERV 10 PLEATED FILTER RACK. 40-24X24 AND 8-12X24 FILTERS. PROVIDE MAGNEHELIC ACROSS FILTER RACK.

*6 SUPPLY OUTLET SOUND POWER LEVELS: 63/86, 125/86, 250/85, 500/70, 1000/67, 2000/71, 4000/66, 8000/65. RETURN INLET SOUND POWER LEVELS: 63/80, 125/85, 250/78, 500/66, 1000/67, 2000/71, 4000/66, 8000/59.

*7 597.25" LONG, 98.62" TALL, 105" WIDE.

*8 UNIT TO BE PROVIDED WITH RETURN SOUND TRAPS, RETURN FANS, MIXING BOX WITH ECONOMIZER, PREFILTERS, SUPPLY FANS, SUPPLY SOUND TRAPS, COOILNG COILS, DISCHARGE PLENUM.

*9 MERV 10 PLEATED FILTER RACK. 9-24X24 AND 3-12X24 FILTERS. PROVIDE MAGNEHELIC ACROSS FILTER RACK.

*10 SUPPLY OUTLET SOUND POWER LEVELS: 63/82, 125/86, 250/76, 500/69, 1000/61, 2000/64, 4000/61, 8000/66. RETURN INLET SOUND POWER LEVELS: 63/69 125/70, 250/69, 500/59, 1000/60, 2000/64, 4000/59, 8000/52.

FAN COIL UNITS

SYMBOL	MANUFACTURER	MODEL	MOTOR CFM	MOTOR E.S.P. IN W.C.	MOTOR HP	MOTOR PH	MOTOR VOLTS	CHILLED WATER COIL E.A.T. DEG F (DB/WB)	CHILLED WATER COIL E.W.T. DEG. F	CHILLED WATER COIL GPM	CHILLED WATER COIL WATER P.D. (FT)	CHILLED WATER COIL MBH (TOTAL/SENSIBLE)	HOT WATER COIL E.A.T. DEG. F	HOT WATER COIL E.W.T. DEG. F	HOT WATER COIL GPM	HOT WATER COIL WATER P.D. (FT)	HOT WATER COIL MBH	REMARKS
FCU-1	IEC	FXY03	249	---	0.03	1	115	---	---	---	---	---	70	180	1.7	3.6	17.1	*1
FCU-2	IEC	VDY20	2400	0.5	1	3	208	75/63	45	11.9	7.3	59.8/48.3	70	180	5.1	6.1	75.8	*2

REMARKS:

*1 FAN COIL TO BE PROVIDED WITH CABINET PAINTED FLAT BLACK. CRITICAL DIMENSIONS, DEPTH OF CABINET IS 9" MAX., HEIGHT OF CABINET 25" MAX., PROVIDE WITH 3 SPEED MOTOR, STAMPED SUPPLY GRILLE ON TOP OF CABINET, FRONT FILTER ACCESS. SOUND POWER: 125/65, 250/64, 500/59, 1K/55, 2K/47, 4K/44, 8K/38.

*2 UNIT WITH VARIABLE SPEED EC MOTOR, 2" PLEATED MERV 8 FILTER, MANUAL AIR VENT WITH DRAIN, DOUBLE WALL CONSTRUCTION, AND CONDENSATE FLOAT SWITCH.

PUMP SCHEDULE

SYMBOL	MANUFACTURER	MODEL	SIZE	GPM	HEAD FT.	BHP	HP	MOTOR RPM	MOTOR PH	MOTOR VOLTS	SHUT OFF HEAD FT.	END OF CURVE FLOW-GPM	TYPE	REMARKS
CWP-1	BELL & GOSSETT	e-1510	5EB	930	75	21.2	25	1800	3	480	95	1350	*1	*2, *3, *4
HWP-1	BELL & GOSSETT	e-1532	1.25BC	105	75	3.72	5	1800	3	480	102	110	*1	*2, *3
HWP-2	BELL & GOSSETT	e-1532	1.25BC	105	75	3.72	5	1800	3	480	102	110	*1	*2, *3

REMARKS:

*1 CLOSE COUPLED FOOT MOUNTED END SUCTION PUMP.

*2 PROVIDE WITH SUCTION DIFFUSER WITH STARTUP STRAINER.

*3 MOTORS TO BE INVERTER DUTY RATED.

*4 PUMP IS TO BE RATED FOR 250 PSIG.

STEAM HEATING COILS

SYMBOL	MANUFACTURER	MODEL	ROWS	F.P.I.	MAX CFM	VEL. FPM	A.P.D.IN W.G.	ENTERING AIR D.B. (F)	LEAVING AIR D.B. (F)	#/HR OF STEAM	ENT. STEAM PSIG	DIMEN. HxW	REMARKS
PH-1	CLIMATE CRAFT	11SD-36X90-5-1-W-Z	1	5	80,000	593	0.10	50	85.2	3,194	15	*1	*2
PH-2	CLIMATE CRAFT	11SD-36X90-5-1-W-Z	1	5	80,000	593	0.10	50	85.2	3,194	15	*1	*2
PH-3	CLIMATE CRAFT	11SD-30X86-5-1-W-Z	1	5	20,000	558	0.09	50	86.4	828	15	*3	*2
PH-4	CLIMATE CRAFT	11SD-30X86-5-1-W-Z	1	5	20,000	558	0.09	50	86.4	828	15	*3	*2

REMARKS:

*1 6 COILS, EACH AT 36" HIGH, 90" LONG, 1" CONNECTIONS. BOLT OFF TO BE REMOVED THROUGH PLENUM DOOR.

*2 "FREEZE RESISTANT" COILS, 0.01" FINS, 0.035" TUBES.

*3 2 COILS, EACH AT 30" HIGH, 86" LONG, 1" CONNECTIONS. BOLT OFF TO BE REMOVED THROUGH PLENUM DOOR.

STEAM TRAPS

SYMBOL	MANUFACTURER	TYPE	MODEL	ORF. SIZE (INCH)	MAX. OPERATING PRESSURE (PSIG)	CONNECTION SIZE (INCH)	CAPACITY (LBS/HR)	SIZING DIFF. PRESSURE (PSIG)	REMARKS
STT-1	BELL & GOSSETT	F&T	FT030C-6	0.39	30	1-1/2"	1000	1/4	*1

REMARKS:

*1 CAST IRON BODY, STAINLESS STEEL PIN, LEVER ASSEMBLY SEAT, AIR VENT AND FLOAT, ALLOW FOR SERVICE WITHOUT REMOVING FROM PIPING.

INDOOR UNITS

SYMBOL	MANUFACTURER	TYPE	MODEL	CAPACITIES (*3) COOLING (MBH)	CAPACITIES (*3) HEATING (MBH)	AIRFLOW CFM (HIGH/LOW)	REFRIGERANT	UNIT BODY DIMENSIONS (IN) H	UNIT BODY DIMENSIONS (IN) W	UNIT BODY DIMENSIONS (IN) D	UNIT PANEL DIMENSIONS (IN) H	UNIT PANEL DIMENSIONS (IN) W	UNIT PANEL DIMENSIONS (IN) D	SOUND PRESSURE (dBA) *2	POWER SUPPLY	RATED AMPS	MAX POWER INPUT (W)	REMARKS
C-36	LG	CEILING CASSETTE	ARNU	36.2	---	918/706	R410A	11-5/16"	33-1/16"	33-1/16"	1-7/16"	37-3/8"	37-3/8"	44/37	208-230/1	1.3	64	*2, *3, *4, *5
D-07	LG	DUCTED	ARNU	7.5	---	270 (@ 0.1" ESP)/200	R410A	7-1/2"	28-7/8"	27-9/16"	---	---	---	27/23	208-230/1	0.4	40	*2, *3, *4, *5
WM-07	LG	WALL MOUNT	ARNU	7.5	---	254/208	R410A	12-7/16"	32-3/16"	7-7/16"	---	---	---	32/28	208-230/1	0.25	30	*1, *2, *3, *4, *5, *6
WM-36	LG	WALL MOUNT	ARNU	35.5	---	918/671	R410A	13-5/8"	46-27/32"	10-7/16"	---	---	---	52/43	208-230/1	0.81	104	*1, *2, *3, *4, *5, *6

REMARKS:

1. UNIT TO BE MOUNTED AS CLOSE TO THE CEILING AS POSSIBLE PER MANUFACTURERS INSTALLATION SPECIFICATION UNLESS OTHERWISE NOTED.
2. PROVIDE AND INSTALL TATTOO SERIES CONDENSATE PUMP, SIZED FOR INDOOR UNIT.
3. RATED COOLING CONDITIONS: 80/67 DEB F INDOOR AND 95/75 DEG F AMBIENT
   RATED HEATING CONDITIONS: 70 DEG F INDOOR AND 47 DEG F AMBIENT
4. PROVIDE MANUFACTURERS CENTRAL CONTROLLER WITH CAMPUS DDC INTERFACE.
5. REFRIGERANT PIPE SIZES AND ROUTING ADJUSTMENTS SHALL BE BY MANUFACTURER. LAYOUT ON DRAWINGS IS DIAGRAMATIC AND TO SHOW INTENDED SYSTEM ZONING.
6. WHERE REFRIGERANT AND CONDENSATE PIPING IS EXPOSED, PROVIDE "NICE" COVER SYSTEM TO CONCEAL PIPING.

INVERTER HEAT PUMP UNITS

SYMBOL	MANUFACTURER	MODEL	COOLING DATA *1 CAPACITY (MBH)	COOLING DATA *1 INPUT POWER (KW)	HEATING DATA *2 CAPACITY (MBH)	HEATING DATA *2 INPUT POWER (KW)	COMPRESSOR TYPE	COMPRESSOR CAPACITY CONTROL RANGE	REFRIGERANT TYPE	REFRIGERANT BASE CHARGE (LBS.)	EER (NON-DUCTED/DUCTED)	SOUND PRESSURE (dBA)	ELECTRICAL DATA POWER SUPPLY	ELECTRICAL DATA MIN CIRCUIT AMPS	ELECTRICAL DATA MOP (A)	ELECTRICAL DATA RATED AMPS	REMARKS
OU-1	LG	ARUM	216.0	15.37	---	---	HSS DC SCROLL	14% - 100%	R-410A	37.5	11.2/10.7	64	460/3	38.3	50	34.4	*1, *2, *3, *4
OU-2	LG	ARUM	233.1	16.8	---	---	HSS DC SCROLL	14% - 100%	R-410A	37.5	10.4/10.4	65	460/3	41.4	50	37.2	*1, *2, *3, *4
OU-3	LG	ARUM	216.0	15.37	---	---	HSS DC SCROLL	14% - 100%	R-410A	37.5	11.2/10.7	64	460/3	38.3	50	34.4	*1, *2, *3, *4
OU-4	LG	ARUM	216.0	15.37	---	---	HSS DC SCROLL	14% - 100%	R-410A	37.5	11.2/10.7	64	460/3	38.3	50	34.4	*1, *2, *3, *4
OU-5	LG	ARUM	216.0	15.37	---	---	HSS DC SCROLL	14% - 100%	R-410A	37.5	11.2/10.7	64	460/3	38.3	50	34.4	*1, *2, *3, *4

REMARKS:

1. RATED COOLING CONDITIONS (DEGREES F): INDOOR - 80 DB / 67 WB, AMBIENT - 95 DB / 75 WB.
2. RATED HEATING CONDITIONS (DEGREES F): INDOOR - 70 DB / 60 WB, AMBIENT - 47 DB / 43 WB (UNIT SHALL HEAT TO -4 DEG F).
3. PROVIDE MANUFACTURERS CENTRAL CONTROLLER WITH CAMPUS DDC INTERFACE.
4. REFRIGERANT PIPE SIZES AND ROUTING SHALL BE BY MANUFACTURER. LAYOUR ON DRAWINGS IS DIAGRAMTIC AND TO SHOW INTENDED SYSTEM ZONING.

VARIABLE VOLUME TERMINAL UNITS

SYMBOL	MANUFACTURER	MODEL	CFM MIN	CFM MAX	DISCHARGE NC @ 3.0" W.C.	DUCT SIZE INLET	DUCT SIZE OUTLET	STATIC DP IN W.G.	ASSOCIATED REHEAT COIL	ASSOCIATED SOUND TRAP NO.	REMARKS
VAV-5	ENVIRO-TEC	SDR	90	300	31	5"	9"x9"	0.01	HC-1, HC-2	ST-1	*1,*2,*3,*4,*5
VAV-6	ENVIRO-TEC	SDR	100	400	33	6"	9"x9"	0.10	HC-1, HC-2	ST-1	*1,*2,*3,*4,*5
VAV-8	ENVIRO-TEC	SDR	190	700	33	8"	11"x9"	0.03	HC-3, HC-4	ST-2	*1,*2,*3,*4,*5
VAV-10	ENVIRO-TEC	SDR	305	1100	34	10"	13"x11"	0.02	HC-5, HC-6	ST-3	*1,*2,*3,*4,*5
VAV-12	ENVIRO-TEC	SDR	440	1600	33	12"	15"x14"	0.02	HC-7, HC-8	ST-4	*1,*2,*3,*4,*5
VAV-14	ENVIRO-TEC	SDR	615	2200	33	14"	19"x16"	0.05	HC-9, HC-10	ST-5	*1,*2,*3,*4,*5
VAV-16	ENVIRO-TEC	SDR	800	3000	35	16"	23"x16"	0.04	HC-11, HC-12	ST-6	*1,*2,*3,*4,*5

REMARKS:

*1 DOUBLE WALL CONSTRUCTION; NO PORTION OF THE AIRSTREAM SHALL BE IN CONTACT WITH THE INSULATION.

*2 LOW LEAKAGE DAMPER WITH CLOSED CELL FOAM GASKET.

*3 SELF-LUBRICATING BEARINGS.

*4 MULTI-AXIS, CENTER AVERAGING AIRFLOW SENSOR.

*5 SOUND POWER LEVELS LISTED ARE AT THE MAXIMUM CFM.

REHEAT COILS

SYMBOL	MANUFACTURER	MODEL	ROWS	F.P.I.	MAX CFM	VEL. FPM	A.P.D.	GPM	W.P.D. IN FT.	WATER VEL.	E.A.T. (F.)	E.W.T. (F.)	HEATING CAP.(MBH)	L.A.T. (F.)	DIM. WxH	REMARKS
RH-1	DAIKIN	5BS0602B	2	6	400	400	0.08	1.0	0.56	1.10	55.0	135	16.6	93.3	12"x12"	VAV-5 & VAV-6 *1
RH-2	DAIKIN	5BS0802A	2	8	400	400	0.07	2.0	1.50	1.63	55.0	135	21.2	103.9	12"x12"	VAV-5 & VAV-6 *1
RH-3	DAIKIN	5BS0802B	2	8	700	560	0.18	1.0	0.62	1.10	55.0	135	26.9	90.5	15"x12"	VAV-8 *1
RH-4	DAIKIN	5BS0902B	2	9	700	560	0.20	2.0	2.01	2.18	55.0	135	35.1	101.3	15"x12"	VAV-8 *1
RH-5	DAIKIN	5BS0902B	2	9	1100	502	0.16	1.0	0.89	1.10	55.0	135	39.7	99.4	21"x15"	VAV-10 *1
RH-6	DAIKIN	5BS1002B	2	10	1100	502	0.18	2.0	2.90	2.18	55.0	135	55.4	101.4	21"x15"	VAV-10 *1
RH-7	DAIKIN	5BS0901A	1	9	1600	568	0.20	2.0	3.31	2.18	55.0	135	66.2	93.1	27"x15"	VAV-12 *1
RH-8	DAIKIN	5BD1002B	2	10	1600	568	0.22	3.0	1.04	1.63	55.0	135	75.9	98.8	27"x15"	VAV-12 *1
RH-10	DAIKIN	5BD1002B	2	10	2200	586	0.23	4.0	2.00	2.18	55.0	135	105.2	99.1	36"x15"	VAV-14 *1
RH-12	DAIKIN	5WH0902B	2	9	3000	500	0.18	8.0	0.6	1.6	55.0	135	150.4	100.9	48"x18"	VAV-16 *1

REMARKS:

*1 0.0095 ALUMINUM FINS AND 0.035 COPPER TUBES.

SOUND TRAPS

SYMBOL	MANUFACTURER	MODEL	DIMEN. WxHxL	MAX CFM	FACE VEL. FPM	P.D. IN. W.G.	INSERTION LOSS dB 1	2	3	4	5	6	7	8	SELF GEN. NOISE dB 1	2	3	4	5	6	7	8	REMARKS
ST-1	IAC	HS	12x12x36	400	400	0.03	7	9	14	19	20	28	30	13	36	29	35	30	31	35	22	20	*1
ST-2	IAC	HS	15x12x36	700	560	0.06	7	9	14	19	20	28	30	13	47	41	42	40	40	43	33	22	*1
ST-3	IAC	HS	21x15x36	1100	502	0.05	6	10	12	15	19	26	32	13	66	61	53	57	55	57	53	46	*1
ST-4	IAC	HS	27x15x36	1600	569	0.06	6	10	12	15	19	26	32	13	66	61	53	57	55	57	53	46	*1
ST-5	IAC	HS	36x15x36	2200	587	0.06	6	10	12	15	19	26	32	13	74	69	63	64	61	63	62	56	*1
ST-6	IAC	HS	48x18x36	3000	500	0.06	6	10	12	15	19	26	32	13	38	31	37	32	33	37	24	22	*1

REMARKS:

*1 FILM LINER TO PROTECT GLASS FIBER FROM AIRFLOW EROSION.

PROVIDE VFDs FOR
THESE ITEMS. VFD
HORSEPOWER AND
QUANTITIES MAY BE
ADJUSTED FOR ACTUAL
EQUIPMENT SELECTIONS
AFTER BID AWARD.

FANS

SYMBOL	MANUFACTURER	MODEL	TYPE	dBA ALL FANS INLET/OUTLET	CFM (TOTAL) N+1	S.P. IN. W.G.	FAN RPM	BHP (EACH)	MOTOR HP	MOTOR RPM	MOTOR PH	MOTOR VOLTS	WHEEL TYPE	WHEEL DIA.	REMARKS
SF-1	CLIMATE CRAFT	24MTX100	*2	97/98	79,063	3.34	1593	7.49	7.5	1175	3	460	PLENUM	24"	
SF-2	CLIMATE CRAFT	24MTX100	*2	97/98	79,063	3.34	1593	7.49	7.5	1175	3	460	PLENUM	24"	
SF-3	CLIMATE CRAFT	18TX75	*3	99/98	20,000	4.88	2635	9.77	15	3550	3	460	PLENUM	18"	
SF-4	CLIMATE CRAFT	18TX75	*3	99/98	20,000	4.88	2635	9.77	15	3550	3	460	PLENUM	18"	
RF-1	CLIMATE CRAFT	27MTX100	*1	89/89	68,540	1.3	977	2.66	5	875	3	460	PLENUM	27"	
RF-2	CLIMATE CRAFT	27MTX100	*1	89/89	68,540	1.3	977	2.66	5	875	3	460	PLENUM	27"	
RF-3	CLIMATE CRAFT	20MTX100	*4	82/84	18,000	1.3	1505	2.24	3	1175	3	460	PLENUM	20"	
RF-4	CLIMATE CRAFT	20MTX100	*4	82/84	18,000	1.3	1505	2.24	3	1175	3	460	PLENUM	20"	
EF-1	GREENHECK	BSQ-200	*5	72/--	5100	1.0	1189	1.94	2	1725	3	208	BACKWARD INCLINED	20"	*6

REMARKS:

*1 NINE FAN ARRAY DESIGNED N+1. ALL SELECTION DATA IS WITH 8 FANS RUNNING. FANS PROVIDED WITH OUTLET SCREEN, BACKDRAFT DAMPER, EXTENDED COPPER LUBE LINES. PIEZOMETRIC FLOW TAP - ALL FANS, ACOUSTIC BAFFLE, MOTOR SHAFT GROUNDING RINGS. SELECT ARRAY TO OPERATE WITH ALL FAN RUNNING OR WITH 1 OFF AT SAME CAPACITY.

*2 NINE FAN ARRAY DESIGNED N+1. ALL SELECTION DATA IS WITH 8 FANS RUNNING. FANS PROVIDED WITH OUTLET SCREEN, ADJUSTABLE WIDTH FAN WHEEL WITH SHUTOFF, EXTENDED COPPER LUBE LINES. PIEZOMETRIC FLOW TAP - ALL FANS, ACOUSTIC BAFFLE, MOTOR SHAFT GROUNDING RINGS, MOTOR REMOVAL WINCH. SELECT ARRAY TO OPERATE WITH ALL FAN RUNNING (80,000 CFM) OR WITH 1 OFF.

*3 FOUR FAN ARRAY DESIGNED N+1. ALL SELECTION DATA IS WITH 3 FANS RUNNING. FANS PROVIDED WITH OUTLET SCREEN, ADJUSTABLE WIDTH FAN WHEEL WITH SHUTOFF, EXTENDED COPPER LUBE LINES. PIEZOMETRIC FLOW TAP - ALL FANS, ACOUSTIC BAFFLE, MOTOR SHAFT GROUNDING RINGS, MOTOR REMOVAL WINCH. SELECT ARRAY TO OPERATE WITH ALL FAN RUNNING OR WITH 1 OFF AT SAME CAPACITY.

*4 FOUR FAN ARRAY DESIGNED N+1. ALL SELECTION DATA IS WITH 3 FANS RUNNING. FANS PROVIDED WITH OUTLET SCREEN, BACKDRAFT DAMPER, EXTENDED COPPER LUBE LINES. PIEZOMETRIC FLOW TAP - ALL FANS, ACOUSTIC BAFFLE, MOTOR SHAFT GROUNDING RINGS. SELECT ARRAY TO OPERATE WITH ALL FAN RUNNING OR WITH 1 OFF AT SAME CAPACITY.

*5 SINGLE INLINE FAN.

*6 BELT DRIVE CENTRIFUGAL INLINE FAN WITH MOTOR VFD RATED WITH SHAFT GROUNDING PROTECTION, AUTOMATIC BELT TENSIONER, GRIP NOTCH BELT(S), DISCONNECT, AND MOTORIZED BACKDRAFT DAMPER.

GRILLES, REGISTERS AND DIFFUSERS

SYMBOL	MANUFACTURER	MODEL	PANEL SIZE	DIFFUSER SIZE	INLET DIMENSIONS	CFM	P.D. (IN. W.G.)	THROW (FT)	DIRECTION OF THROW	NC	MOUNTING	REMARKS
S-1	PRICE	ASPD	24"x24"	12"x12"	5" RD	109	0.108	3-5-8	4-WAY	17	SEE PLANS	*1
S-2	PRICE	ASPD	24"x24"	20"x20"	6" RD	196	0.07	3-4-7	4-WAY	23	SEE PLANS	*1
S-3	PRICE	ASPD	24"x24"	20"x20"	8" RD	279	0.07	4-6-9	4-WAY	22	SEE PLANS	*1
S-4	PRICE	ASPD	24"x24"	20"x20"	10" RD	382	0.1	5-7-10	4-WAY	20	SEE PLANS	*1
S-5	PRICE	ASPD	24"x24"	24"x24"	12" RD	471	0.11	5-8-12	4-WAY	17	SEE PLANS	*1
S-6	PRICE	AMDA	24"x24"	24"x24"	18"x18"	900	0.065	16-19-27	4-WAY	21	SEE PLANS	*3
S-7	PRICE	ASPD	24"x24"	24"x24"	24" RD	641	0.127	5-7-13	4-WAY	18	SEE PLANS	*2
S-8	PRICE	620	---	12"x10"	12"x10"	415	0.093	9-13-18	45 DEG	17	SIDEWALL	*4
S-9	PRICE	LBMH	---	6"	---	314/FT	0.121	28-33-39	SIDEWALL	34	SIDEWALL	*5
S-10	PRICE	620	---	30"x4"	30"x4"	415	0.093	9-13-18	45 DEG	17	SIDEWALL	*7
S-11	PRICE	620	---	24"x4"	24"x4"	365	0.03	9-12-17	45 DEG	20	SIDEWALL	*7
R-1	PRICE	630	24"x24"	14"x14"	14"x14"	472	0.01	---	---	20	SEE PLANS	*6
R-2	PRICE	630	24"x24"	22"x22"	22"x22"	1244	0.01	---	---	21	SEE PLANS	*6
R-3	PRICE	LBMH	---	6"	---	314/FT	0.1	---	---	38	SIDEWALL	*5
E-1	PRICE	630	24"x24"	14"x14"	14"x14"	472	0.01	---	---	20	SEE PLANS	*6
E-2	PRICE	630	24"x24"	22"x22"	22"x22"	1244	0.01	---	---	21	SEE PLANS	*6

REMARKS:

*1 ALUMINUM PLAQUE DIFFUSER WITH INSULATED BACKPAN AND OFF WHITE FINISH. BLANK OFF DIFFUSER TO PROVIDE THROW DIRECTIONS OF OTHER THAN 4-WAY WHERE INDICATED ON DRAWINGS.

*2 ALUMINUM PLAQUE DIFFUSER WITH INSULATED BACKPAN AND CUSTOM FINISH SELECTED BY ARCHITECT. BLANK OFF DIFFUSER TO PROVIDE THROW DIRECTIONS OF OTHER THAN 4-WAY WHERE INDICATED ON DRAWINGS.

*3 ALUMINUM MODULAR LOUVERED FACE DIFFUSER WITH ADJUSTABLE PATTERN DEFLECTORS AND CUSTOM FINISH SELECTED BY ARCHITECT.

*4 ALUMINUM DOUBLE DEFLECTION SUPPLY GRILLE WITH INDIVIDUALLY ADJUSTABLE BLADES ON 3/4" CENTERS AND OFF-WHITE FINISH.

*5 ALUMINUM HEAVY DUTY MANDREL TUBE LINEAR BAR GRILLE WITH 3/16" BARS ON 7/16" CENTERS, REMOVABLE CORE, AND CUSTOM FINISH SELECTED BY ARCHITECT. PAINT DUCT BEHIND GRILLE FLAT BLACK.

*6 ALUMINUM LOUVERED RETURN/EXHAUST GRILLE WITH 45 DEGREE BLADES ON 3/4" CENTERS AND OFF WHITE FINISH. PAINT DUCT BEHIND RETURN GRILLE FLAT BLACK.

*7 ALUMINUM DOUBLE DEFLECTION SUPPLY GRILLE WITH INDIVIDUALLY ADJUSTABLE BLADES ON 1/2" CENTERS AND CUSTOM FINISH.

CONTROL VALVES

SYMBOL	MANUFACTURER	TYPE	SERVICE	GPM - LBS/HR	STEAM INLET PRESS (PSI)	DESIGN P.D. (PSI)	DESIGN P.D. (FT)	DESIGN Cv	SIZE	ACTUAL Cv	ACTUAL P.D. (PSI)	ACTUAL P.D. (FT)	DESIGN POINT % OF TRAVEL	RANGEABILITY	MIN. CLOSE OFF PRESS. (PSI)	RECOMM. OPER. P.D. (PSI)	RATED PRESSURE (PSI)	REMARKS
CV-1	JOHNSON	*1	HOT/CHILLED WATER	0.5 - 1.0	---	---	---	---	1/2"	0.7	2.0	4.7	---	50	100	100	175	VAV REHEAT & FAN COIL UNIT COIL *3, *4, *5
CV-2	JOHNSON	*1	HOT/CHILLED WATER	1.5 - 3.0	---	---	---	---	1/2"	1.7	3.1	7.2	---	50	100	100	175	VAV REHEAT & FAN COIL UNIT COIL *3, *4, *5
CV-3	JOHNSON	*1	HOT/CHILLED WATER	3.5 - 4.0	---	---	---	---	3/4"	3.0	1.8	4.1	---	50	100	100	175	VAV REHEAT & FAN COIL UNIT COIL *3, *4, *5
CV-4	JOHNSON	*1	HOT/CHILLED WATER	4.5 - 8.5	---	---	---	---	1"	5.8	2.1	4.9	---	50	100	100	175	VAV REHEAT & FAN COIL UNIT COIL *3, *4, *5
CV-5	JOHNSON	*1	HOT/CHILLED WATER	8.5 - 12.0	---	---	---	---	1"	6.4	3.5	8.1	---	50	100	100	175	VAV REHEAT & FAN COIL UNIT COIL *3, *4, *5
CV-6	NELES	*2	CHILLED WATER	930.0	---	4.3	10.0	446.0	6"	1260.0	1.3	0.5	78.3	75	100	100	250	MAIN CHILLED WATER BUILDING VALVE
CV-7	NELES	*2	CHILLED WATER	930.0	---	4.3	10.0	446.0	6"	1260.0	1.3	0.5	78.3	75	100	100	250	CHILLED WATER PUMP BYPASS VALVE
CV-8A	NELES	*2	STEAM	532.0	30.0	15.0	34.5	8.4	1"	45.0	0.4	0.8	60.2	75	30	30	150	1/3 VALVE FOR 1/2 OF AHU-1 PREHEAT COILS
CV-8B	NELES	*2	STEAM	532.0	30.0	15.0	34.5	8.4	1"	45.0	0.4	0.8	60.2	75	30	30	150	1/3 VALVE FOR 1/2 OF AHU-1 PREHEAT COILS
CV-9A	NELES	*2	STEAM	1064.0	30.0	15.0	34.5	16.8	1.5"	110.0	0.2	0.5	49.7	75	30	30	150	2/3 VALVE FOR 1/2 OF AHU-1 PREHEAT COILS
CV-9B	NELES	*2	STEAM	1064.0	30.0	15.0	34.5	16.8	1.5"	110.0	0.2	0.5	49.7	75	30	30	150	2/3 VALVE FOR 1/2 OF AHU-1 PREHEAT COILS
CV-10A	NELES	*2	CHILLED WATER	175.0	---	4.3	10.0	83.9	2"	180.0	0.9	2.2	87.3	75	100	100	250	CHILLED WATER VALVE FOR 1/2 OF AHU-1
CV-10B	NELES	*2	CHILLED WATER	175.0	---	4.3	10.0	83.9	2"	180.0	0.9	2.2	87.3	75	100	100	250	CHILLED WATER VALVE FOR 1/2 OF AHU-1
CV-11	NELES	*2	STEAM	276.0	30.0	15.0	34.5	4.4	1"	15.0	0.9	2.0	61.5	75	30	30	150	1/3 VALVE FOR AHU-3 PREHEAT COILS
CV-12	NELES	*2	STEAM	552.0	30.0	15.0	34.5	8.7	1"	45.0	0.4	0.9	61.7	75	30	30	150	2/3 VALVE FOR AHU-3 PREHEAT COILS
CV-13	NELES	*2	CHILLED WATER	71.0	---	4.3	10.0	34.1	1.5"	110.0	0.4	1.0	73.0	75	100	100	250	CHILLED WATER VALVE FOR AHU-3
CV-14A	NELES	*2	STEAM	532.0	30.0	15.0	34.5	8.4	1"	45.0	0.4	0.8	60.2	75	30	30	150	1/3 VALVE FOR 1/2 OF AHU-2 PREHEAT COILS
CV-14B	NELES	*2	STEAM	532.0	30.0	15.0	34.5	8.4	1"	45.0	0.4	0.8	60.2	75	30	30	150	1/3 VALVE FOR 1/2 OF AHU-2 PREHEAT COILS
CV-15A	NELES	*2	STEAM	1064.0	30.0	15.0	34.5	16.8	1.5"	110.0	0.2	0.5	49.7	75	30	30	150	2/3 VALVE FOR 1/2 OF AHU-2 PREHEAT COILS
CV-15B	NELES	*2	STEAM	1064.0	30.0	15.0	34.5	16.8	1.5"	110.0	0.2	0.5	49.7	75	30	30	150	2/3 VALVE FOR 1/2 OF AHU-2 PREHEAT COILS
CV-16A	NELES	*2	CHILLED WATER	175.0	---	4.3	10.0	83.9	2"	180.0	0.9	2.2	87.3	75	100	100	250	CHILLED WATER VALVE FOR 1/2 OF AHU-2
CV-16B	NELES	*2	CHILLED WATER	175.0	---	4.3	10.0	83.9	2"	180.0	0.9	2.2	87.3	75	100	100	250	CHILLED WATER VALVE FOR 1/2 OF AHU-2
CV-17	NELES	*2	STEAM	276.0	30.0	15.0	34.5	4.4	1"	15.0	0.9	2.0	61.5	75	30	30	150	1/3 VALVE FOR AHU-4 PREHEAT COILS
CV-18	NELES	*2	STEAM	552.0	30.0	15.0	34.5	8.7	1"	45.0	0.4	0.9	61.7	75	30	30	150	2/3 VALVE FOR AHU-4 PREHEAT COILS
CV-19	NELES	*2	CHILLED WATER	71.0	---	4.3	10.0	34.1	1.5"	110.0	0.4	1.0	73.0	75	100	100	250	CHILLED WATER VALVE FOR AHU-4

REMARKS:

1. BALL VALVE.
2. ROTARY, SEGMENT/V-PORT, RE. PROVIDE WITH ELECTRIC ACTUATOR. ACTUATOR TO BE CAPABLE OF DRIVING TO N.C. POSITION ON LOSS OF POWER.
3. USE ON VAV REHEAT AND FAN COIL UNIT COILS WITH FLOWS IN RANGES SCHEDULED. SEE PLANS FOR ACTUAL FLOWS. USE 3-WAY VALVES WHERE INDICATED ON DRAWINGS.
4. PROVIDE CHILLED WATER VALVES RATED FOR 250 PSI WOG.
5. ALL REHEAT VALVES FOR TERMINAL HEATING ARE TO BE BALL TYPE VALVES WITH UPPER THRUST BEARING AND RESILIENT SEAT. THE VALVE IS TO BE RATED FOR 300°F MAX TEMPERATURE AND 175 PSIG MAX PRESSURE WITH A CARBON STEEL BODY AND STAINLESS STEEL BALL. THE VALVES ARE TO BE EQUIPPED WITH AN ELECTRIC MODULATING ACTUATOR IN ALL CASES. ACTUATORS OR OUTPUT TRANSDUCERS SHALL ACCEPT PROPORTIONAL MILLIAMP, MILLIVOLT OR VOLTAGE. USE OF FLOATING OR INCREMENTAL OPEN LOOP CONTROL ACTUATORS THAT DO NOT PROVIDE POSITIVE POSITION FEEDBACK TO THE DDC CONTROLLER SHALL BE UNACCEPTABLE.

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HVAC SCHEDULES

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