

**UNIVERSITY OF CENTRAL ARKANSAS
INVITATION FOR COMPETITIVE BID**

Submit Bids To: Procurement Department
University of Central Arkansas
Wingo Hall Room 113
201 Donaghey Avenue
Conway, AR 72035

General Description of bid: "Equipment Only" Package for Schichtl Hall Renovation

| | |
|--|--|
| Date Issued: October 26, 2022 | Bid Number: UCA-23-027 |
| UCA Physical Plant Contact: Danielle Barron | Bid Closing Date: Nov. 15, 2022 |
| Email: dbarron@uca.edu | Bid Opening Time: 10:00 a.m. |
| UCA Bid Contact Person: Cassandra McCuien-Smith | Bid Closing Time: 10:00 a.m. |
| Email: cmccuien@uca.edu | Fax: 501-450-5020 |
| Phone Number: 501-450-3173 | Type of Contract: FIRM |

Bid submittals must be properly marked with the Bid Number, bidders return address, phone, email and submitted prior to the due date and time listed above. Bids under \$35,000 can be faxed. Bids exceeding \$35,000 must be submitted in a sealed envelope.

| | |
|----------------------------|------------------------------|
| Company Name: _____ | Contact Person: _____ |
| Address: _____ | Phone Number: _____ |
| _____ | Email: _____ |
| _____ | Signature: _____ |
| _____ | Title: _____ |

THIS PAGE MUST BE SIGNED AND RETURNED WITH THE BID.

Special Terms and Conditions:

- 1. Freight:** Inside delivery must be included in total bid as FOB Destination, Conway, AR.
- 2.** If bidding equal brand, specifications must be submitted with the bid or the bid will be rejected.
- 3.** Plans and drawing specifications are attached. Carefully, review all documents for the exact equipment required for bidding purposes.
- 4.** You must submit pricing using the attached document. No other form used for pricing will be acceptable.

| Item | Brand/Description | |
|------|-------------------|---|
| 1. | | <p data-bbox="630 216 919 254">Air Handling Units</p> <p data-bbox="630 300 1406 338">\$ _____</p> <p data-bbox="630 426 1060 464">Brand & Model Number bid:</p> <p data-bbox="630 541 1406 558">_____</p> <p data-bbox="630 940 1406 978">\$ _____</p> <p data-bbox="272 989 597 1062">AR/Faulkner/Conway Sales Tax</p> <p data-bbox="630 1108 1406 1146">\$ _____</p> <p data-bbox="321 1157 597 1230">Inside Delivery/Shipping</p> <p data-bbox="630 1325 1406 1362">\$ _____</p> <p data-bbox="415 1367 597 1404">Grand Total</p> |

| Item | | Brand/Description |
|------|---------------------------------|------------------------------------|
| 2. | | Air Terminal Units |
| | | \$ _____ |
| | | Brand & Model Number bid: _____ |
| | AR/Faulkner/Conway Sales Tax | \$ _____ |
| | Inside Delivery/Shipping | \$ _____ |
| | Grand Total | \$ _____ |

| Item | Brand/Description | |
|------|---------------------------------|---------------------------|
| 3. | | Exhaust Fan |
| | | \$ _____ |
| | | Brand & Model Number bid: |
| | | _____ |
| | AR/Faulkner/Conway Sales Tax | \$ _____ |
| | Inside Delivery/Shipping | \$ _____ |
| | Grand Total | \$ _____ |

| Item | | Brand/Description |
|------|--|---|
| 4. | | <p data-bbox="625 210 722 247">Boiler</p> <p data-bbox="625 294 1404 336">\$ _____</p> <p data-bbox="625 420 1055 462">Brand & Model Number bid:</p> <p data-bbox="625 535 1404 556">_____</p> <p data-bbox="625 934 1437 976">\$ _____</p> <p data-bbox="267 976 592 1060">AR/Faulkner/Conway Sales Tax</p> <p data-bbox="625 1102 1404 1144">\$ _____</p> <p data-bbox="316 1144 592 1228">Inside Delivery/Shipping</p> <p data-bbox="625 1312 1404 1354">\$ _____</p> <p data-bbox="414 1354 592 1396">Grand Total</p> |

| Item | Brand/Description | |
|------|-------------------|---|
| 5. | | <p>Pumps</p> <p>\$ _____</p> <p>Brand & Model Number bid:</p> <p>_____</p> <p>\$ _____</p> <p>AR/Faulkner/Conway Sales Tax</p> <p>\$ _____</p> <p>Inside Delivery/Shipping</p> <p>\$ _____</p> <p>Grand Total</p> |

| Item | Brand/Description | |
|------|-------------------|---|
| 6. | | <p data-bbox="630 216 902 254">Air/Dirt Separator</p> <p data-bbox="630 302 1403 340">\$ _____</p> <p data-bbox="630 428 1058 466">Brand & Model Number bid:</p> <p data-bbox="630 548 1403 552">_____</p> <p data-bbox="630 940 1435 978">\$ _____</p> <p data-bbox="269 989 597 1062">AR/Faulkner/Conway Sales Tax</p> <p data-bbox="630 1110 1403 1148">\$ _____</p> <p data-bbox="321 1159 597 1232">Inside Delivery/Shipping</p> <p data-bbox="412 1371 597 1409">Grand Total</p> <p data-bbox="630 1327 1403 1365">\$ _____</p> |

STANDARD TERMS AND CONDITIONS (IFBs)

- 1. GENERAL:** Any Special Terms and Conditions included in the Invitation for Bids override these Standard Terms and Conditions. The Standard Terms and Conditions and any Special Terms and Conditions become a part of any contract entered into if any or all parts of the bid are accepted by the University of Central Arkansas, hereafter called University or UCA.
- 2. ACCEPTANCE AND REJECTION:** The University of Central Arkansas reserves the right to accept or reject all or any part of a bid or any and all bids, to waive any informalities and minor technicalities and to award the bid to best serve the interest of the University and State of Arkansas. This Invitation for Bid does not in any way commit UCA to contract for the commodities/services listed herein.
- 3. BID SUBMISSION:** Bids must be submitted to the Purchasing Department on this form with attachments, when appropriate, on or before the date and time specified for the bid opening. If this form is not used, the bid may be rejected. Each bid submitted must be properly identified with a minimum of Bid Number, Time and Date of Opening. The bid should be typed or printed in ink. Late bids will not be considered under any circumstances.
- 4. SIGNATURE:** Failure to sign a bid will disqualify it. The person signing the bid should show title or authority to bind the firm in a contract. Signature means a manual or an electronic or digital method executed or adopted by a party with the intent to be bound by or to authenticate a record which is (a) unique to the person using it; (b) capable of verification; (c) under the sole control of the person using it; (d) linked to data in a manner that if the data are changed, the electronic signature is invalidated.
- 5. NO BID:** If not submitting a bid, the bidder should respond by returning the front page of this form, making it a No Bid, and explaining the reason. Individual bidders may be removed from the University's Bidders List by failure to respond three times in succession.
- 6. PRICES:** Bid pricing on the unit price to include FOB destination to UCA. In cases of errors in extension, unit prices shall govern. Prices are firm and not subject to escalation unless otherwise specified in the Invitation for Bid. Unless otherwise specified, the bid must be firm for acceptance for thirty (30) days from the bid opening dates. "Discount from List" bids are not acceptable unless requested in the Invitation for Bid. Time or cash discounts will not be considered. Quantity discounts should be included in the price of the item.
- 7. QUANTITIES:** Quantities stated on "firm" contracts are actual requirements of the University. The quantities stated in "term" contracts are estimates only and are not guaranteed. Bid unit price on the estimated quantity and unit of measure specified. The University may order more or less than the estimated quantity on any "term" contract.
- 8. BRAND NAME REFERENCES:** Unless specified "No Substitutes", any catalog brand name or manufacturer's reference used in the bid invitation is descriptive only, not restrictive, and used to indicate the type and quality desired. Bids on brands of like nature and quality will be considered. If bidding on other than the referenced specifications the bid must show the manufacturer, brand or trade name, and other descriptions, and should include the manufacturer's illustration and complete description of the product(s) offered. If the bidder fails to submit such the bid can be rejected. The University reserves the right to determine whether a substitute offered is equivalent to and meets the standards of the item specified. The University may require the bidder to supply additional descriptive material. The bidder guarantees that the product offered will meet or exceed specifications identified in the bid invitation. If the bidder takes no exception to the specifications or referenced data in the bid, he/she will be required to furnish the product according to the brand, names, numbers, etc., as specified in the invitation for bid document.
- 9. GUARANTY:** All items shall be newly manufactured, in first class condition, latest model and design, including, where applicable, containers suitable for shipment and storage, unless otherwise indicated in the bid invitation. The bidders hereby guarantee that everything furnished hereunder will be free from defects in design, workmanship and material,

that if sold by drawing, sample or specifications, it will conform thereto and will serve the function for which it was furnished. The bidder further guarantees that if the items furnished hereunder are to be installed by the bidder, such items will function for which it was intended. The bidder also guarantees that all applicable laws have been complied with relating to construction, packaging, labeling, and registration. The bidder's obligations, under this paragraph, shall survive for a minimum of one year from the date of delivery, unless otherwise specified herein.

10. SAMPLES: Samples, or demonstrators, when requested, must be furnished free of expense to the University. If samples are not destroyed during the reasonable examination they will be returned to the bidder, if requested, within ten days following the complete examination of the item(s), at bidder's expense. Each sample should be marked with the bidder's name, address, bid number and item number.

11. TESTING PROCEDURES FOR SPECIFICATIONS COMPLIANCE: Tests may be performed on samples, or demonstrators, submitted with the bid, or on samples taken from regular shipments. In the event products tested fail to meet or exceed all conditions and requirements of the original specifications, the cost of the sample used and the reasonable cost of the testing shall be borne by the bidder.

12. AMENDMENTS: The bid documents cannot be altered or amended after the bid opening except as permitted by regulation.

13. TAXES AND TRADE DISCOUNTS: Do not include state sales tax. However, other local county, city, or municipal sales or use tax should be included in the bid. Trade discounts should be deducted from the unit price and the net price should be shown on the bid.

14. AWARD: Any contract, as the results of this Invitation for Bid, shall be awarded with reasonable promptness by written notice to the lowest responsible bidder whose bid meets the requirements and criteria set forth in the Invitation for Bid. The University reserves the right to award the item(s) listed on this Invitation for Bid "individually", by "groups", "all or none", or by any other method as deemed in the best interest of the University, as deemed by the UCA Procurement Official. In the event all bids exceed available funds, as certified by the appropriate fiscal officer, the Agency Procurement Official is authorized in situations where time or economic considerations preclude re-solicitation of work of a reduced scope to negotiate an adjustment of the bid price, including changes in the bid requirements, with the lowest responsible and responsive bidder, in order to bring the bid within the amount of available funds.

NOTE: Firm Contract: A written University Purchase Order mailed, or otherwise furnished, to the successful bidder within the time of acceptance specified in the Invitation for Bid results in a binding contract that requires the contractor to furnish the commodities or services as stated on the purchase order which will reference the original Invitation for Bid documents and number. Vendor is to immediately initiate action to comply with the requirements of the purchase order, which by reference will incorporate all the requirements contained in the original Invitation for Bid. **Term Contracts:** A Contract Award will be issued to the successful bidder. It results in a binding obligation of the item(s) or service(s) for specific pricing and time frame without further action, at that time, by either party. The Contract Award does not authorize any shipment(s) or service(s) to be provided. Shipment of commodities or the providing of service, related to a "term contract" is only authorized by the receipt of a University Purchase Order, by the Contractor, that will list the actual requirement, pricing, and delivery location and contract number.

15. TERM OF CONTRACT: The Invitation for Bid, Contract Award or Purchase Order will clearly state the period of time the contract will be in effect for each individual contract.

16. DELIVERY ON CONTRACTS: The Invitation for Bid, Contract Award and/or Purchase Order will state the number of days to place a commodity, equipment and/or service in the designated location under normal conditions. If the Contractor cannot meet the stated delivery, alternate delivery schedules may become a factor in an award. The UCA Purchasing Department has the right to extend delivery if reasons appear valid. If the Contractor cannot

meet the delivery date, the University reserves the right to procure the items elsewhere and any additional cost will be borne by the Contractor.

17. DELIVERY REQUIREMENTS: No substitutions or cancellations are permitted without prior written approval of the UCA Purchasing Department. Delivery shall be made during the normal University work hours of 8:00 am to 4:30 pm CT, unless prior approval for other delivery time(s) has been obtained for the UCA Purchasing Department. Packing memoranda shall be enclosed with each shipment.

18. DEFAULT: All commodities furnished will be subject to inspection and acceptance of the University after delivery. Backorders, default in promised delivery, or failure to meet the original specifications of the order will authorize the UCA Purchasing Department to cancel the contract, or any portion(s) of it, and procure the commodities, equipment and/or services elsewhere and charge the full increase in expense, if any, to the defaulting contractor. Consistent failure to meet delivery dates/requirements may cause removal from the vendor listing or suspension of eligibility for any award.

19. VARIATION IN QUANTITY: The University assumes no liability for commodities produced, processed or shipped in excess of the amount specified on University contracts.

20. UNIVERSITY/STATE PROPERTY: Any specifications, drawings, technical information, dies, cuts, negatives, positives, data or any other items furnished to the contractor in contemplation hereunder shall remain the property of the University/State, be kept confidential to the extent allowed by Arkansas law, be used only as expressly authorized, and returned at the contractor's expense to the FOB point, properly identifying what is being returned.

21. PATENTS OR COPYRIGHTS: The contractor agrees to indemnify and hold the University harmless from all claims, damages and costs, including legal fees, arising from infringements of any patents or copyrights.

22. INVOICING: The contractor shall be paid upon the completion of all of the following: (1) delivery and acceptance of the commodities or services, (2) submission of a properly itemized invoice, with the specified number of copies that reflect the contract/purchase order number(s), item(s), quantity and pricing; (3) and the proper and legal processing of the invoice by the University. Invoices must be sent to the University, Attn: Accounts Payable Department, as shown on the original contract or purchase order.

23. ASSIGNMENT: Any contract entered into pursuant to any contract issued by the University is not assignable nor the duties there under delegable by either party without the written consent of both parties of the original agreed upon contract.

24. LACK OF FUNDS: The University may cancel any contract to the extent funds are no longer legally available for expenditures under the contract. The University will return any delivered but unpaid for commodities in normal conditions to the contractor. If the University is unable to return the commodities in a normal condition, and there are no funds legally available to pay for the commodities, the contractor may file a claim with the Arkansas Claims Commission for the actual expense.

25. DISCRIMINATION: In order to comply with the provisions of Act 54 of 1977, as amended, relating to unfair employ practices, the bidder/contractor agrees as follows: (a) the bidder/contractor will not discriminate against any employee or applicant for employment because of race, sex, color, age, religion, disability, or national origin; (b) in all solicitations or advertisements for employees, the bidder/contractor will state that all qualified applicants will receive consideration without regard to race, color, sex, age, religion, disability, or national origin; (c) the bidder/contractor will furnish such relevant information and reports as requested by the Human Resources Commission for the purpose of determining compliance with the statute; (d) failure of the bidder/contractor to comply with the statute, rules and regulations promulgated there under and this nondiscrimination clause shall be deemed a breach of contract and it may be cancelled, terminated or suspended in whole or part; (e) The bidder/contractor

will include the provision of items (a) through (d) in every subcontract so that such provisions will be binding upon such subcontractors or vendor.

26. ETHICS: It shall be a breach of ethical standards for a person to be retained, or to retain a person, to solicit or secure a University/State of Arkansas contract upon an agreement or understanding for a commission, percentage, brokerage or contingent fee, except for retention of bona fide employees or bona fide established commercial selling agencies maintained by the contractor for the purpose of securing business. Any violation of this ethics statement can result in the cancellation of any contract with the University.

27. CONTRACT AND GRANT DISCLOSURE AND CERTIFICATION: Any contract or amendment to any contract, executed by the University of Central Arkansas which exceeds \$25,000 shall require the contractor to disclose information as required under the terms of Executive Order 98-04 and the regulations pursuant thereto. Failure of any person or entity to disclose or the violation of any rule, regulation or policy promulgated by the Department of Finance and Administration pursuant to this order shall be considered a material breach of the terms of the contract. The material breach of the terms shall subject the party failing to disclose, or in violation, to all legal remedies available to the University under the provisions of existing law. The attached Contract and Grant Disclosure and Certification Form (F-1 and F-2) shall be used for the disclosure purpose. No contract or amendment to any existing contract will be approved until the contractor completes and returns the disclosure form.

28. ANTITRUST: As part of the consideration for entering into any contract pursuant to an Invitation for Bid, the bidder named on the Invitation for Bid, acting herein by the authorized individual, its duly authorized agent, hereby assigns, sells and transfers to the University/State of Arkansas all rights, title and interest in and to all causes of action it may have under the antitrust laws of the United States or the State of Arkansas for price fixing, which causes of action have accrued prior to the date of the assignment and which relates solely to the particular goods or services purchased or produced by this State pursuant to any resulting contract with this University.

29. ARKANSAS TECHNOLOGY ACCESS CLAUSE: The vendor expressly acknowledges that state funds may not be expended in connection with the purchase of information technology unless that system meets certain statutory requirements in accordance with State of Arkansas technology policy standards relating to accessibility by persons with visual impairments. Accordingly, the vendor represents and warrants to UCA that the technology provided to UCA for purchase is capable, either by virtue of features included within the technology or because it is readily adaptable by use with other technology, of (1) providing equivalent access for effective use by both visual and non-visual means; (2) presenting information, including prompts used for interactive communications, in formats intended for non-visual use; and (3) being integrated into networks for obtaining, retrieving, and disseminating information used by individuals who are not blind or visually impaired. For purposes of this paragraph, the phrase "equivalent access" means a substantially similar ability to communicate with or make use of the technology, either directly by features incorporated within the technology or by other reasonable means such as assisting devices or services which would constitute reasonable accommodations under the Americans with Disabilities Act or similar state or federal laws. Examples of methods by which equivalent access may be provided include, but are not limited to, keyboard alternatives to mouse commands and other means of navigating graphical displays, and customizable display appearance. If requested, the vendor must provide a detailed plan for making this purchase accessible and/or a validation of concept demonstration.

30. CANCELLATION: Either party may cancel any contract or item award, for cause, by giving a thirty (30) day notice of intent to cancel. Cause for the University to cancel will include, but is not limited to, cost exceeding current market prices for comparable purchases, request for increase in prices during the period of the contract, or failure to perform to contract conditions. The contractor will be required to honor all purchase orders that were prepared and dated prior to the date of expiration, or cancellation. Cancellation by the University does not

relieve the contractor of any liability arising out of a default or nonperformance. If a contract is cancelled due to a request for increases in pricing, or failure to perform, that contractor will be removed from the bidders/vendors list for a period up to twenty-four (24) months. Cause for the vendor to cancel a contract will include, but is not limited to, the item(s) being discontinued and unavailable from the manufacturer or non-payment of vendor invoices by the University.

31. ALTERATION OF ORIGINAL IFB/RFP DOCUMENT: The original written or electronic language of the IFB/RFP shall not be changed or altered, except by approved written addendum issued by the UCA Purchasing Department. This does not eliminate a vendor/contractor from taking exception(s) to these documents, but does clarify that he/she cannot change the original document's written or electronic language. If a vendor/contractor wishes to make exception(s), to any of the original language, they must be submitted by the vendor/contractor in separate written or electronic, language in a manner that clearly explains the exception(s). If a vendor's/contractor's submittal is discovered to contain alterations/changes to the original written or electronic documents, the vendor's/contractor's response may be declared as "non-responsible" and the response will not be considered.

32. SOVEREIGN IMMUNITY: Nothing in this agreement shall be construed to waive the sovereign immunity of the State of Arkansas or any entity thereof, including the University of Central Arkansas.

33. WORK FOR HIRE: All goods, products, software or other items (collectively the "deliverables") under this agreement shall be and remain the exclusive property of UCA. All right, title and interest in such deliverables shall vest in, and be the property of, UCA. The parties agree that all deliverables shall, to the fullest extent permitted by law constitute "work for hire" under the U.S. copyright law, or any other law. Company shall retain its rights in its know-how, concepts, materials and information developed independently of this agreement. However, with regard to the deliverables paid for by UCA and produced under this agreement, UCA is hereby granted an exclusive, perpetual license (royalty-free) to use such deliverables in UCA's business. Company agrees to execute and deliver to UCA any and all instruments, documents or assignments to reflect the matters set forth in this paragraph.

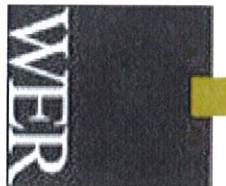
SCHICHTL HALL RENOVATION ** EQUIPMENT PROCUREMENT PACKAGE **

UNIVERSITY OF CENTRAL ARKANSAS
CONWAY, ARKANSAS



UNIVERSITY OF
CENTRAL
ARKANSAS

H+N ARCHITECTS



September 2022

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UNIVERSITY OF CENTRAL ARKANSAS
CONWAY, ARKANSAS
PETTIT & PETTIT JOB NO. 22-003**

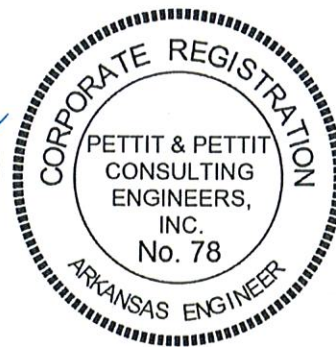
**** EQUIPMENT PROCUREMENT PACKAGE ****

DIVISION 23 HVAC

| | |
|----------|---------------------------------------|
| 23 05 66 | UVC Emitter Ultra Violet Disinfection |
| 23 21 23 | Hydronic Pumps |
| 23 34 23 | HVAC Power Ventilators |
| 23 36 16 | Air Terminal Units – Variable Volume |
| 23 52 16 | Condensing Boilers |
| 23 73 13 | Modular Central Station Air Handlers |

The Engineer of Record for Division 23 of the Specifications for the Schichtl Hall Renovation **Equipment Procurement Package **, University of Central Arkansas, Conway, Arkansas, (Pettit & Pettit Job No. 22-003) is:

09/16/22
Date



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PETTIT & PETTIT
CONSULTING ENGINEERS, INC.

SECTION 23 05 66
UVC EMITTER ULTRAVIOLET DISINFECTION FOR IAQ: HVAC MOLD,
BACTERIA & ODOR CONTROL

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED IN OTHER SECTIONS:

- A. Motor starters, disconnects, power wiring of HVAC equipment, variable frequency drives and UVC Emitters: Division 26.

1.02 QUALITY ASSURANCE:

- A. UL Compliance: Comply with UL Standard 1995 as applicable to usage of UVC Emitters in HVAC Equipment.
- B. ISO Certification: Fixtures must be manufactured in an ISO 9001:2000 registered facility.

1.03 DELIVERY, STORAGE AND HANDLING:

- A. Store UVC Emitters in a clean dry place and protect from weather and construction traffic. Handle UVC Emitters carefully to avoid damage to components, enclosures and finish. Leave factory-shipping covers in place until installation and only when called for in the installation instructions. Do not install damaged components; replace and return damaged components to equipment manufacturer.
- B. Comply with manufacturer's installation instructions placement, wiring and testing.

PART 2 PRODUCTS

2.01 UVC EMITTERS

A. GENERAL

- 1. Acceptable Manufacturers:
 - a. Steril-Aire, Inc. Model RIK Series as shown on Schedule or Drawings.
 - b. Architect approved equal and provide documentation by a recognized Industry Independent Testing Lab on substitute UVC Emitter performances. Performance results must meet or exceed the performance for Emitters specified in an HVAC environment.
- 2. Quality Assurance:
 - a. Qualifications: Each component and product are to be inbound and outbound tested before shipment in accordance with ISO 9001:2000 test procedures and shall be produced in an ISO 140001 approved facility.
 - b. Output Verification: Independent certified testing shall indicate that when the RIK Emitter first installed total output per one inch arc length shall not be less than 7.8 $\mu\text{W}/\text{cm}^2$ at one meter, in a 400-fpm airstream of 50 °F.
- 3. Warranty:
 - a. Fixture and Emitter shall be 100% warranted to be free from factory defects for a period of one year. The Power Supplies and Fixtures shall be warranted for 5 years.
 - b. The Coil shall be substantially free of Mold at the end of the manufacturer's Emitter warrantee period, or 9000 hours, whichever is longer.

B. DESIGN REQUIREMENT

1. Irradiation – UVC Emitters and fixtures are to be installed downstream of the coil horizontally across the full face of the coil in sufficient quantity and in such an arrangement so as to provide an equal distribution of UVC energy on the coil and in the drain pan. UVC Emitter lamps shall be installed horizontally across the full width of the face of the coil (i.e., perpendicular to the coil fins) to minimize the shadowing effect of the coil fins.
2. Intensity- Intensity shall be measured by a UVC Radiometer that is accurate to $\pm 3\%$ radiometric and photometric for NIST transfer standards in the monochromatic irradiance at 254nm. The Radiometer shall have a full cosine response filter.

C. EQUIPMENT

1. The Rapid Install Kit (RIK) System
 - a. The Rapid Install Kit shall be factory assembled and tested. It shall consist of the following components: factory pre-wired power supplies with m12 connector cables and IP67 compliant female Emitter sockets, spring clips for each Emitter, foot bracket assembly, ceiling "H" bracket, adjustable aluminum columns, and all fasteners. All RIK's include SJO cable between housings.
 - b. The adjustable column shall be constructed of aluminum channel. It shall be designed for mounting inside the plenum.
 - c. The column brackets (2) shall be constructed of galvanized steel. The "H" bracket shall be used with self-drilling, self-tapping screws to attach the column to the plenum ceiling. The foot bracket assembly shall be placed at the base of the column for height adjustment and non-slip footing in the drain pan.
 - d. The housing shall be constructed of galvanized steel to withstand HVAC environments and shall be factory installed with 2 pre-wired 110-277 V power supplies. The Emitter shall be held in place and supported in the airstream by Steril-Aire Mounting options.
 - e. The power supply shall be a UL-935, Class P and Type 1 outdoor. The power supply design shall include RF and EMI suppression per FCC part 18. The power supply shall be designed to maximize photon production, irradiance supplies and reliability in cold airstreams of 0-140 °F, 100% RH. The power supply shall be available in a universal 110-277 V, 50/60 Hz, single phase. The power supply shall also have end of life protection.
 - f. The Emitter shall be a very high output, hot cathode, T5 diameter, that produces germicidal UVC of 253.7 nm. The single-ended Emitter shall operate in air velocities of up to 2000 fpm and air temperatures of 35-140°F. It shall produce no ozone or other secondary contaminants.
 - g. The socket shall be a 4-pin stepped type design constructed of UV Stabilized, Flame Retardant Polycarbonate with Silicone Rubber seals to achieve IP-67 protection at -40° to 125 °C.
2. Unitary System
 - a. The Unitary Kit for Smaller Air Handlers shall be factory assembled and tested. The Kit shall consist of a power supply and a mounting solution. The single-ended Emitter shall be ordered separately.
 - b. The power supply shall be a 25Watt unit with connector for Emitter. It shall be suitable for single-phase input power of either 120 volts or 230 volts (+/- 10%), 50 Hertz. The design shall include RF and EMI suppression. The power supply input wire length shall be 10". The Emitter to power supply sleeved wire length shall be 14".

- c. The socket shall be a Circline® 4 pin type to facilitate connection to the Emitter for ease of installation and service.
 - d. The Emitter shall be a high output, hot cathode, T5 diameter, Circline cell-base type that produces a germicidal UVC band of 253.7 nm. The single-ended UVC Emitter shall be designed to maximize photon production, irradiance and reliability in cold air streams of 35-140 °F, 99% RH and up to 2000 fpm. It shall produce no ozone or other secondary contaminants. Optional Emitter extension cords in 11" and 32" lengths (with connectors) shall be available.
 - e. The Mounting Solution: Steril-Aire provides a variety of mounting brackets for UVC Emitters. The Unitary Kit for Smaller Air Handlers includes one of the following mounting options: Short Hooks, Spring Clips, Flat Plate Lamp Holder (for metal), Flat Plate Lamp Holder (for plastic), Insert Lamp Holder, U Bracket – each packaged with mounting screws (as required) to facilitate installation in most major brands. The power supply shall comply with ANSI/UL Standards 153, 1598 and 1995 and CSA standards. The manufacturer shall be an ISO. The supplier of the UVC system(s) shall provide documentation demonstrating the calculations for the specified minimum and average intensities for each UVC system as listed in the UVC Emitter Germicidal Lamp Disinfection Schedule during the submittal process.
- D. System Design Performance:
The supplier of the UVC system(s) shall provide documentation demonstrating the calculations for the specified minimum and average intensities for each UVC system as listed in the UVC Emitter Germicidal Lamp Disinfection Schedule during the submittal process.
- E. System Commissioning:
1. UVC system shall be commissioned by manufacturer field representative.
 2. Commissioning shall verify system intensity level for each UVC system demonstrating that it has met or exceeded the minimum and average UVC intensities as specified. The commissioning shall be performed upon installation of UVC system for each AHU or RTU during operating conditions.
 3. Points of measurements for UVC system minimum intensity shall be demonstrated by measuring at the four extreme corners (extreme position is defined as one square centimeter of coil at one corner of the area covered by the lamp) of the coil surface in the same plane as the irradiated surface. Additionally, points of measurements shall be taken every four (4) square feet across the face of the coil.
 4. The average intensities shall be calculated by averaging the four (4) corner measurements with those measurements taken every four (4) square feet.
 5. Intensity shall be measured by a UVC Radiometer that is accurate to $\pm 3\%$ radiometric and photometric for NIST transfer standards in the monochromatic irradiance at 254nm. The Radiometer shall have a full cosine response filter. This measurement shall be used to verify compliance
 6. Upon completion of the commissioning report demonstrating and verifying design intensity levels, actual recorded levels, and measurement locations all data shall be presented upon submission of an Operation and Maintenance Manual.

PART 3 INSTALLATION

3.01 INSTALLATION OF UVC EMITTERS

- A. Coordinate with installation of HVAC equipment and install Emitters as indicated after such equipment is properly installed.
- B. Provide an interlock switch on the access to the UVC Emitters to turn the lights off when the access is opened.
- C. Provide a view port to enable the maintenance technician to view Emitters to determine that they are operating.
- D. If specified to include a Steril-Aire stationary radiometer, install the radiometer and adjust and set in accordance with manufacturer recommendations.
- E. Install an on/off indicator capable of informing BMS if there is an Emitter failure.
- F. Install provided Caution Labels on all accesses to the Emitters.

END OF SECTION

**SECTION 23 2123
HYDRONIC PUMPS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Basic Requirements for Hydronic Pumps for HVAC Systems.

1.02 RELATED SECTIONS

- A. Section 23 0500 – Common Work Results for Heating, Ventilating and Air Conditioning.
- B. Section 23 0548 – Vibration and Seismic Controls for HVAC Piping and Equipment.
- C. Section 23 2113 – Hydronic Piping.
- D. Division 23 -- All Sections.

1.03 REFERENCES

- A. ANSI/UL 778 - Motor Operated Water Pumps.

1.04 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacture, assembly and field performance of pumps, whose products have been in satisfactory use in similar service.
- B. Alignment: Base mounted pumps shall be aligned by qualified millwright and alignment certified.

1.05 SUBMITTALS

- A. Submit shop drawings and product data under provisions of 01 33 23 and Section 23 05 00.
- B. Submit certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
- C. Submit manufacturer's installation instructions under provisions of Division 01.

1.06 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 23 05 00.
- B. Include installation instructions, assembly views, lubrication instructions and replacement parts list.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 23 05 00.
- B. Store and protect products under provisions of Section 23 05 00.

1.08 EXTRA PARTS

- A. Provide one extra set of mechanical seals for each pump.

PART 2 PRODUCTS

2.01 GENERAL CONSTRUCTION REQUIREMENTS

- A. Balance: Rotating parts, statically and dynamically.
- B. Pump Motors: Operate at 1750 rpm unless specified otherwise.
- C. Pump Connections: Flanged.

2.02 SPLIT COUPLED BASE-MOUNTED END SUCTION PUMPS

- A. The pump shall be single, end suction type with radically split, top center-line discharge, self-venting casing. The casing-to-cover gasket shall be confined on the atmospheric side to prevent blow-out possibility.
- B. Pump construction shall be cast iron, bronze fitted and shall be fitted with a long- life, product lubricated, drip-tight mechanical seal, with O-ring seat retainer, designed for the specified maximum temperature and pressure.
- C. The casing suction and discharge connections shall be the same size and shall be provided with drilled and tapped seal vent and pressure gauge connections.
- D. Pump impeller shall be stainless steel or bronze, fully enclosed type. Impeller shall be dynamically balanced.
- E. The shaft shall be fitted with a Stainless-Steel shaft sleeve and be supported by two heavy duty ball bearings. The design shall allow Back Pull-Out servicing, enabling the complete rotating assembly to be removed without disturbing the casing piping connections.
- F. The pump shall be mounted on a rigid, single piece baseplate, with grouting hole, and connected by flexible coupling with guard, to a 460U, 3 phase, inverter duty motor of Federal approved premium, efficiency level and suitable for across-the-line starting.
- G. The housing shall be hydrostatically tested to 150% maximum working pressure.
- H. The unit shall be suitable for the conditions shown on the pump schedule.

2.04 SPLIT COUPLED VERTICAL IN-LINE PUMPS

- A. Pump casing shall be cast iron, suitable for 175 psi (1206 kPa) working pressure at 140°F (60°C). Ductile iron pump casings are suitable for pressures to 250 psi (1724 kPa). The casing shall be hydrostatically tested to 150% maximum working pressure. The pump internals shall be capable of being serviced without disturbing the pipe connections. The casing suction and discharge connections shall be the same size and shall be provided with drilled and tapped seal vent and pressure gauge connections.
- B. Pump impeller shall be stainless steel or bronze, fully enclosed type. Impeller shall be

dynamically balanced.

- C. A bronze shaft sleeve, extending the full length of the mechanical seal area, shall be provided.
- D. Mechanical Seal shall be single spring inside type with carbon against Ceramic faces. EPDM elastomer with stainless steel spring and hardware shall be provided. Seal vent line shall be factory installed and shall be piped from the seal area to the pump suction connection.

2.05 BOILER CIRCULATION PUMPS

- A. Pump casing shall be cast iron, suitable for 125 psi (862 kPa) working pressure at 210°F (99°C). The casing shall be hydrostatically tested to 150% maximum working pressure. The pump internals shall be capable of being serviced without disturbing the pipe connections. The flanged casing suction and discharge connections shall be the same size and shall be provided with drilled and tapped seal vent and pressure gauge connections where available.
- B. Pump impeller shall be non-metallic, as part of a self-lubricating replaceable cartridge design. Impeller shall be dynamically balanced. Entire cartridge shall be able to be replaced without removing the pump body from the piping connections.
- C. A ceramic shaft bearing shall be provided.

2.06 APPROVED MANUFACTURERS

- A. Armstrong
- B. Bell & Gossett
- C. Taco
- D. Engineer Approved

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install pumps in accordance with manufacturer's instructions.
- B. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.
- C. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
- D. Provide drains for bases and seals, piped to and discharging into floor drains.
- E. Lubricate pumps before start-up.
- F. Install base mounted pumps on concrete inertia base, with anchor bolts, set and level.

- G. Qualified millwright shall check, align, and certify base mounted pumps prior to start-up.

END OF SECTION

**SECTION 23 3423
HVAC POWER VENTILATORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Basic Requirements for HVAC Power Ventilators.

1.02 RELATED SECTIONS

- A. Section 23 0500 – Common Work Results for Heating, Ventilating, and Air Conditioning Systems.
- B. Section 23 0548 – Vibration and Seismic controls for HVAC Piping and Equipment.
- C. Section 23 3100 – HVAC Ducts and Casings.

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacturer of power ventilators and exhaust fans, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. AMCA Compliance: Provide power roof ventilators and exhaust fans bearing the Air Movement and Control Association, Inc. (AMCA) Certified Ratings Seal.
- C. UL Compliance: Provide power roof ventilator and exhaust fans electrical components which have been listed and labeled by Underwriters Laboratories (UL).

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's data for power ventilators and exhaust fans, including specifications, capacity ratings, dimensions, weights, materials, accessories furnished, and installation instructions.
- B. Maintenance Data: Submit maintenance instructions, including lubrication instructions, motor and drive replacement, and spare parts lists. Include this data in maintenance manuals.

PART 2 PRODUCTS

2.01 ROOF-MOUNTED FANS

- A. Uni-Dome exhauster shall be belt drive, centrifugal fan of the size, capacity and electrical characteristics as scheduled on the Drawings.
- B. Fan housing and wheel shall be of all aluminum construction. Fan shaft shall be steel.
- C. Wheels shall be statically and dynamically balanced.
- D. Motor and drive shall be located in an enclosed weatherproof compartment separate from the air stream. Motor and drive shall have permanently lubricated ball bearings rated for

200,000 hours operating life. Drives shall be variable pitch and sized for 165 percent of scheduled motor horsepower.

- E. Fan shall be equipped with birdscreen, disconnect switch, internal wiring using "Sealtite" flexible conduit from switch to motor, and gravity backdraft damper.
- F. Entire housing shall be factory primed coated to accept field applied finish coat.
- G. Provide pre-fabricated roof curb with prime coat finish suitable for field painting, compatible with roof pitch to provide level top.

2.02 APPROVED MANUFACTURERS

- A. Roof-Mounted - Exhaust Fan:
 - 1. Greenheck.
 - 2. Cook.
 - 3. Engineer Approved.

PART 3 EXECUTION

3.01 GENERAL

- A. Examine areas and conditions under which power ventilators and exhaust fans are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF POWER VENTILATORS

- A. General: Except as otherwise indicated or specified, install ventilators and exhaust fans in accordance with manufacturer's installation instructions and recognized industry practices to ensure that ventilators serve their intended function.
- B. Coordinate ventilator and exhaust fan work with work of roofing, walls, and ceilings, as necessary for proper interfacing.
- C. Ensure that power ventilators and exhaust fans are wired properly, with correct motor rotation, and positive electrical motor grounding.
- D. Remove shipping bolts and temporary supports within ventilators and exhaust fans. Adjust dampers for free operation.

3.03 TESTING

- A. General: After installation of ventilators and exhaust fans has been completed, test each to demonstrate proper operation of units at performance requirements specified. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

3.04 SPARE PARTS

- A. General: Furnish to Owner, with receipt, 1 spare set of belts for each belt drive power ventilator and exhaust fans.

END OF SECTION

**SECTION 23 3616
AIR TERMINAL UNITS - VARIABLE VOLUME**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single duct terminal units.
 - 1. Variable volume.
 - 2. Constant volume.
- B. Integral heating coils.
 - 1. Hot water.
- C. Sound attenuator.

1.02 RELATED SECTIONS

- A. Section 23 0923 - Controls and Instrumentation.
- B. Section 23 2113 - Hydronic Piping: Connections to heating coils.
- C. Section 23 2114 - Hydronic Specialties: Connections to heating coils.
- D. Section 23 3100 - Ductwork.
- E. Section 23 3300 - Ductwork Accessories.
- F. Section 23 3700 - Air Outlets and Inlets.

1.04 REFERENCES

- A. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- B. UL 181 - Factory-Made Air Ducts and Connectors.
- C. UL 1995, Heating and Cooling Equipment.
- D. CUL C22.2 No. 236, Heating and Cooling Equipment.
- E. ASTM A 527 (Steel Sheet, Zinc Coated Galvanized).
- F. A-A-1419 or F-F-310 Federal specification (filter element, Air conditioning, Viscous-impingement or Dry type, replaceable), Tested per UL 900.

1.05 SUBMITTALS

- A. Submit shop drawings and product data sheets indicating configuration, general assembly, and materials used in fabrication.
- B. Submit product performance data indicating design air flow, minimum static pressure drop, fan operating condition.

- C. Submit installation, operation and maintenance documentation.

1.06 QUALIFICATIONS

- A. Manufacturer: The company manufacturing the products specified in this section shall have a minimum of ten years experience producing products of this type.

1.07 SYSTEM RESPONSIBILITY

- A. The contractor shall be responsible for any and all costs associated with any and all changes resulting from the use of a supplier other than the one used as "basis of design".

1.08 WARRANTY

- A. Provide manufacturer's parts warranty for one year from substantial completion.

PART 2 PRODUCT

2.01 MANUFACTURERS

- A. Specified Manufacturers
 1. Price.
 2. Titus.
 3. Trane.
 4. Engineer approved.

2.02 MANUFACTURED UNITS

- A. Identify each terminal unit with clearly marked identification label and airflow indicator. Label shall include unit nominal air flow, maximum factory-set air flow, minimum factory-set air flow, and coil type.

2.03 FABRICATION

- A. Casings: Units shall be completely factory-assembled, manufactured of corrosion protected steel, and fabricated with a minimum of 18-gauge metal on the high pressure (inlet) side of the terminal unit damper and 22-gauge metal on the low pressure (outlet) side and unit casing.
- B. INSULATION - Foil Faced - The interior surface of unit casing is acoustically and thermally lined with a minimum of 1" foil faced insulation. The interior foil liner shall isolate the fiberglass insulation from the airstream and allow for cleaning of the terminal unit interior surfaces. Insulation shall meet NFPA-90A, UL 181 and bacteriological standard ASTM C 665.
- C. Assembly: Primary air control damper, airflow sensor, fans, controls and optional heating coil in single cabinet.
- D. Rectangular Supply Air Outlet Connections: Rectangular outlet connections for units without optional heating coils on the outlet of the terminal unit shall be flange type. Rectangular outlet connections for units with optional heating coils on the outlet of the terminal unit shall be slip and drive type.

2.04 PRIMARY AIR CONTROL DAMPER ASSEMBLY

- A. Locate primary air control damper assembly inside unit casing. Construct the damper assembly from extruded aluminum and/or a minimum 22-gauge galvanized steel components. Maximum damper leak rate shall not exceed 1% of damper nominal CFM at 4-inch wg. differential.
- B. Provide damper assembly with integral flow sensor. Flow sensor shall be provided regardless of control type. Flow sensor shall be a multi-point, averaging, ring or cross type. Bar or single point sensing type is not acceptable.

2.05 HEATING COILS

- A. Hot Water Heating Coil: Coils shall be factory-installed and shall consist of aluminum plated fins and seamless copper tubes. Fins shall have full fin collars to provide accurate fin spacing and maximum fin-to-tube contact. Tubes shall be mechanically expanded into the fin collars. Coils shall be leak tested under water to 450 psig pressure. Supply and return water connections shall be on the same side of the coil.
- B. Capacity: Provide coils in capacities as scheduled on the drawings.

2.06 WIRING

- A. Factory install and wire power line fusing, a disconnect switch and a 24 VAC transformer for control voltage on units. Provide terminal strip in control box for field wiring of thermostat and power source.
- B. Factory install and wire all terminal unit controls. Install electrical components in control box with removable cover. Incorporate single point electrical connection to power source.
- C. Disconnect switch - Provide single duct terminals with a factory installed and wired switch to disconnect power to the unit.
- D. Power Line Fuse - Provide single duct terminal units with integral power line fusing installed in the control box to prevent overcurrent damage to the unit.
- E. Control Transformer - Provide single duct terminal units with a factory installed and wired 24 VAC transformer to provide control voltage power to the unit.

2.07 DIRECT DIGITAL VAV CONTROLS

- A. Direct Digital Controls
 1. General. DDC Controls, actuator and costs to mount, calibrate and test the system shall be the responsibility of Section 23 0923 ATC/Building Management System Contractor.
 2. Multi-point, multi-axis flow ring or cross sensor to be furnished and mounted by terminal unit manufacturer. Single point or flow bar sensors are not acceptable. Shall be capable of maintaining airflow to within +/- 5 percent of rated unit airflow setpoint with 1.5 duct diameters straight duct upstream from the unit.

2.08 TESTING / VERIFICATION

- A. Maximum Casing Leakage: 1 percent of nominal air flow at 0.5 in wg inlet static pressure.

- B. Maximum Damper Leakage: 1 percent of design air flow at 4 in wg inlet static pressure.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.02 ADJUSTING

- A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design air flow to 25 percent nominal air flow for cooling only units and 30 percent for units with heating coils.

END OF SECTION

**SECTION 23 5216
CONDENSING BOILERS**

PART 1 GENERAL

1.01 SCOPE:

- A. Work Included: Boiler-Burner units, and related accessories as indicated and required for a complete system. Verify delivery pressure of natural gas furnished by Gas Company and provide additional gas pressure regulator if available delivery pressure does not satisfy pressure requirements of equipment furnished for this project.

1.02 RELATED INFORMATION AND REQUIREMENTS

- A. Common Work Results for HVAC - Section 23 05 00
- B. Testing and Balancing - Section 23 05 93

1.03 REVIEW OF MATERIALS: Submittal data is required for the following listed materials

- A. Boiler-Burner Units
- B. The boiler-burner unit shall be manufactured by:
 - 1. Raypack Xfyre.
 - 2. Engineer Approved.

1.04 WARRANTY

- A. The equipment manufacturer's warranty shall be for a period of one year from the date of substantial completion. The warranty shall include parts and labor costs for the repair or replacement of defects in material or workmanship.

PART 2 PRODUCTS

2.01 The boiler shall have a modulating input rating of 500,000 Btu/Hr, an output of 487,500 Btu/Hr and shall be operated on Natural Gas. The boiler shall be capable of full modulation with a turndown ratio of 7:1.

- A. The boiler shall bear the ASME "H" stamp for 160 psi working pressure and shall be National Board listed. The boiler shall have a fully welded, stainless steel, fire tube heat exchanger. Multiple pressure vessels in a single enclosure are not acceptable. There shall be no banding material, bolts, gaskets or "O" rings in the pressure vessel construction. The heat exchanger shall be designed for a single-pass water flow to limit the water side pressure drop. Pressure drop shall be no greater than 2.2 psi at 75 GPM. The condensate collection basin shall be constructed of welded stainless steel. The complete heat exchanger assembly shall carry a ten (10) year limited warranty.
- B. The boiler shall be certified and listed by C.S.A. International under the latest edition of the harmonized ANSI Z21.13 test standard for the U.S. and Canada. The boiler shall comply with the energy efficiency requirements of the latest edition of ASHRAE 90.1 and the minimum efficiency requirements of the latest edition of the AHRI BTS-2000 Standard as defined by the Department of Energy in 10 CFR Part 431. The boiler shall operate

at a minimum of 97% Combustion and Thermal Efficiency at full fire as registered with AHRI. The boiler shall be certified for indoor installation.

- C. The boiler shall be constructed with a heavy gauge steel jacket assembly, primed and pre-painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. A burner/flame observation port shall be provided for observing the burner flame and combustion chamber. The burner shall be a premix design constructed of high temperature stainless steel with a woven Fecralloy outer covering to provide smooth operation at all modulating firing rates. The boiler shall be supplied with a negative pressure regulation gas valve and be equipped with a pulse width modulation blower system to precisely control the fuel/air mixture to the burner. The boiler shall operate in a safe condition with gas supply pressures as low as 4 inches of water column. The burner flame shall be ignited by direct spark ignition with flame monitoring via a flame sensor.
- D. The boiler shall utilize a 24 VAC control circuit and components. The control system shall have a factory installed display for boiler set-up, boiler status, and boiler diagnostics. All components shall be easily accessed and serviceable from the front and top of the jacket. The boiler shall be equipped with a temperature/pressure gauge; high limit temperature control with manual reset; ASME certified pressure relief valve set for 50 psi (standard); outlet water temperature sensor with a dual thermistor to verify accuracy; system supply water temperature sensor; outdoor air sensor, flue temperature sensor with dual thermistor to verify accuracy; low water cut off with manual reset, blocked drain switch and a condensate trap for the heat exchanger condensate drain.
- E. The boiler shall feature a control system which is standard and factory installed with 128 x 128 resolution display, password security, outdoor air reset, pump delay with freeze protection, pump exercise, ramp delay featuring six steps, domestic hot water prioritization with limiting capabilities, USB drive for simple uploading of parameters and a PC port connection for connection to a local computer for programming and trending. A secondary operating control that is field mounted outside or inside the appliance is not acceptable. The boiler shall have alarm contacts for any failure, runtime contacts and data logging of runtime at given modulation rates, ignition attempts and ignition failures. The boiler shall have a built-in "Cascade" with leader redundancy to sequence and rotate while maintaining modulation of up to eight boilers of different Btu inputs without utilization of an external controller. The internal "Cascade" function shall be capable of lead-lag, efficiency optimization, front-end loading, and rotation of lead boiler every 24 hours. The boiler shall be capable of remote communication via optional Remote Connectivity with the capability of historical trending and sending text message or email alerts to notify the caretaker of a boiler alarm and remote programming of onboard boiler control. The boiler shall be capable of controlling an isolation valve (offered by manufacturer) during heating operation and rotation of open valves in standby operation for full flow applications. The control must have optional capability to communicate via Modbus protocol with a minimum of 46 readable points. The boiler shall have an optional gateway device which will allow integration with LON or BacNet protocols.
- F. The control system shall increase fan speed to boost flame signal when a weak flame signal is detected during normal operation. A 0-10 VDC output signal shall control a variable speed boiler pump (offered by manufacturer) to keep a fixed Delta T across the boiler regardless of the modulation rate. The boiler shall have the capability to receive a 0-10 VDC input signal from a variable speed system pump to anticipate changes in system heat load in order to prevent flow related issues such as erratic temperature cycling.

- G. The Boiler shall be equipped with two terminal strips for electrical connection. A low voltage connection board with 46 connection points for safety and operating controls, i.e., Alarm Contacts, Runtime Contacts, Louver Proving Switch, Tank Thermostat, Domestic Hot Water Building Recirculation Pump Contacts, Domestic Hot Water Building Recirculation Temperature Sensor Contacts, Remote Enable/Disable, System Supply Temperature Sensor, Outdoor Temperature Sensor, Tank Temperature Sensor, Modbus Building Management System Signal and Cascade Control Circuit. A high voltage terminal strip shall be provided for Supply voltage. Supply voltage shall be 120 volt / 60 hertz / single phase on all models. The high voltage terminal strip plus integral relays are provided for independent pump control of the System pump, the Boiler pump and the Domestic Hot Water pump.
- H. The boiler shall be installed and vented with a direct vent system with vertical roof top termination of both the exhaust vent and combustion air. The flue shall be Category IV approved material constructed of PVC and CPVC. A separate pipe shall supply combustion air directly to the boiler from the outside. The boiler's total combined air intake length shall not exceed 100 equivalent feet. The boiler's total combined exhaust venting length shall not exceed 100 equivalent feet. The air inlet must terminate on the rooftop with the exhaust.
- I. The boiler shall have an independent laboratory rating for Oxides of Nitrogen (NOx) to meet the requirements of South Coast Air Quality Management District in Southern California and the requirements of Texas Commission on Environmental Quality. The manufacturer shall verify proper operation of the burner, all controls and the integrity of the heat exchanger by connection to water and venting for a factory fire test prior to shipping.
- J. The boiler shall operate at altitudes up to 4,500 feet above sea level without additional parts or adjustments. The boiler shall be certified for operation at elevations of 4,500 feet, and above, by a 3rd party organization.
- K. The boiler shall be suitable for use with polypropylene glycol up to a 50% concentration. The de-rate associated with the glycol will vary per glycol manufacturer.

STANDARD CONSTRUCTION

The boiler shall be constructed in accordance with the following code requirements as standard equipment. Manufacturing of special models to meet the below code requirements is not acceptable.

California Code
Massachusetts Code
Kentucky Code
CRN Approval in Canada

Note: Due to the large disparity in CSD-1 interpretation from state to state, please confirm to the factory all controls required in your jurisdiction.

PART 3 EXECUTION

3.01 SPACE CONDITIONS: Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until satisfactory conditions are corrected.

3.02 INSTALLATION

- A. Coordinate as necessary with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this section.
- B. Install the work of this section in strict accordance with the approved design drawings and the requirements of the contract.
- C. Follow manufacturer's instructions in the delivery, storage, handling and installation of all equipment, accessories and connections.

3.03 TESTING AND ACCEPTANCE

- A. Upon completion of the installation, provide the services of factory authorized personnel to verify that the installation meets the specifications, the manufacturer's written instructions and all state and local codes and to perform startup and initial adjustment of the boiler, burner and controls in accordance with the manufacturer's written instructions.
- B. Where inspections or tests show materials or workmanship are deficient, replace or repair as necessary, and repeat the inspection or test until the specified standards are achieved.

3.04 INSTRUCTIONS AND VERIFICATION

- A. Furnish of Owners manuals, which include instructions for installation, operation and maintenance of the boiler(s) as specified in 23 05 00.
- B. Document the results of the startup and initial adjustment on the manufacturer's startup record and complete the manufacturer's CSD-1 verification form. Submit the startup record and CSD-1 form to the Engineer.

END OF SECTION

**SECTION 23 7313
CENTRAL STATION AIR HANDLER**

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Applied Air Handling Units.

1.02 RELATED SECTIONS

- A. Section 23 0713 - Duct Work Insulation.
- B. Section 23 0923 - Building Automation and Control Systems

1.03 REFERENCES

- A. AMCA Publication 99 - Standards Handbook.
- B. AMCA Publication 611 - Certified Ratings Program - Airflow Measurement Performance
- C. AMCA Standard 500-D - Laboratory Methods of Testing Dampers for Rating.
- D. ANSI/ABMA Standard 9 - Load Ratings and Fatigue Life for Ball Bearings.
- E. ANSI/AMCA Standard 204 - Balance Quality and Vibration Levels for Fans.
- F. ANSI/AMCA Standard 610 - Laboratory Methods of Testing Airflow Measuring Stations for Rating.
- G. ANSI/AHRI Standard 410 - Forced Circulation Air-Cooling and Air-Heating Coils.
- H. ANSI/AHRI Standard 430 - Central Station Air Handling Units.
- I. ANSI/ASHRAE Standard 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
- J. ANSI/ASHARE Standard 62.1 - Ventilation for Acceptable Indoor Air Quality.
- K. ANSI/ASHARE Standard 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- L. ANSI/NEMA MG 1 - Motors and Generators.
- M. ANSI/UL 900 - Standard for Safety Air Filter Units.
- N. AHRI Standard 260 - Sound rating of Ducted Air Moving and Conditioning Equipment.
- O. ASHRAE Standard 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems.
- P. ASTM C1071 - Thermal and Acoustic Insulation (Mineral Fiber, Duct Lining Material).

- Q. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Material and Facings.
- R. ASTM E477 - Standard Test Method for Measure Acoustical and Airflow Performance of Duct Liner
- S. NFPA 70 - National Electrical Code
- T. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilation Systems.
- U. UL 1995 - Standard for Safety Heating and Cooling Equipment

1.04 QUALITY ASSURANCE

- A. Air Coils: Certify capacities, pressure drops and selection procedures in accordance with current AHRI Standard 410.
- B. Air handling units with fan sections utilizing single fans shall be rated and certified in accordance with AHRI Standard.
- C. Air handling units with fan sections utilizing multiple fans shall be rated in accordance with AHRI Standard 430 for airflow, static pressure, and fan speed performance.
- D. Airflow monitoring station: Certify airflow measurement station performance in accordance with AMCA 611.

1.05 SUBMITTALS

- A. No equipment shall be fabricated or delivered until the receipt of approved shop drawings from the Owner or Owner's approved representative.
- B. AHU manufacturer shall provide the following information with each shop drawing/product data submission:
 1. All electrical, piping, and ductwork requirements, including sizes, connection locations, and connection method recommendations.
 2. Each component of the unit shall be identified and mechanical specifications shall be provided for unit and accessories describing construction, components, and options.
 3. All performance data, including capacities and airside and waterside pressure drops, for components.
 4. Fan curves shall be provided for fans with the design operating points indicated. Data shall be corrected to actual operating conditions, temperatures, and altitudes.
 5. For units utilizing multiple fans in a fan section, a fan curve shall be provided showing the performance of the entire bank of fans at design conditions. In addition, a fan curve shall be provided showing the performance of each individual fan in the bank of fans at design conditions. Also, a fan curve shall be provided showing the performance of the bank of fans, if one fan is down. The percent redundancy of the bank of fans with one fan down shall be noted on the fan curve or in the tabulated fan data.
 6. A filter schedule must be provided for each air handling unit supplied by the air handling unit manufacturer. Schedule shall detail unit tag, unit size, corresponding filter section location within the AHU, filter arrangement (e.g.,

angled/flat), filter depth, filter type (e.g., pleated media), MERV rating, and filter quantity and size.

7. A schedule detailing necessary trap height shall be provided for each air handling unit. Schedule shall detail unit tag, unit size, appropriate trap schematic with recommended trap dimensions, and unit supplied base rail height. Contractor shall be responsible for additional trap height required for trapping and insulation beyond the unit supplied base rail height by adequate housekeeping pad.
8. A coil valve coordination schedule shall be provided for each air handling unit supplied by the air handling unit manufacturer. Schedule shall detail unit tag, coil type and corresponding section location within the AHU, valve style (e.g., global, ball), valve type (e.g., electronic 2-way/3-way), valve position (e.g., normally open/closed), size, flow coefficient (CV), and close-off pressure.
9. An electrical MCA - MOP schedule shall be provided for each electrical circuit to which field-power must be supplied. Schedule to detail unit tag, circuit description, voltage/phase/hertz, Minimum Circuit Ampacity (MCA), and calculated Maximum Overcurrent Protection (MOP).
10. Sound data shall be provided using AHRI 260 test methods. Unit discharge, inlet, and radiated sound power levels in dB shall be provided for 63, 125, 250, 500, 1000, 2000, 4000 and 8000Hz.

- C. The AHU manufacturer shall provide appropriate sets of submittals as referenced in the General Conditions and shall submit to the Owner electronic copies of the IOM.

1.06 REGULATOR REQUIREMENTS

- A. Agency Listings/Certifications
 1. Unit shall be manufactured to conform to UL 1995 and shall be listed by either UL/CUL or ETL. Units shall be provided with listing agency label affixed to the unit. In the event the unit is not UL/CUL or ETL approved, the contractor shall, at his/her expense, provide for a field inspection by a UL/CUL or ETL representative to verify conformance. If necessary, contractor shall perform modifications to the unit to comply with UL/CUL or ETL as directed by the representative, at no additional expense to the owner.
 2. Certify air handling units in accordance with AHRI Standard 430. Units shall be provided with certification label affixed to the unit. If air handling units are not certified in accordance with AHRI Standard 430, contractor shall be responsible for expenses associated with testing of units after installation to verify performance of fan(s). Any costs incurred to adjust fans to meet scheduled capacities shall be the sole responsibility of the contractor.
 3. Certify air handling coils in accordance with AHRI Standard 410. Units shall be provided with certification label affixed to the unit. If air handling coils are not certified in accordance with AHRI Standard 410, contractor shall be responsible for expenses associated with testing of coils after installation to verify performance of coil(s). Any costs incurred to adjust coils to meet scheduled capacities shall be the sole responsibility of the contractor.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- B. Units shall ship fully assembled up to practical shipping and rigging limitations. Units not shipped fully assembled shall have tags and airflow arrows on each section to indicate

location and orientation in direction of airflow. Shipping splits shall be clearly defined on submittal drawings. Cost associated with non-conformance to shop drawings shall be the responsibility of the manufacturer. Each section shall have lifting lugs for field rigging, lifting and final placement of AHU section(s). AHU's less than 100-inches wide shall allow for forklift transport and maneuverability on the jobsite.

- C. Deliver units to jobsite with fan motor(s), sheave(s), and belt(s) completely assembled and mounted in units.
- D. Unit shall be shipped in a clear shrink-wrap or stretch-wrap to protect unit from in-transit rain and debris per ASHRAE 62.1 recommendations.
- E. Installing contractor shall be responsible for storing AHU in a clean, dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.08 START-UP AND OPERATING REQUIREMENTS

- A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters in place, bearings lubricated (if applicable), condensate properly trapped, piping connections verified and leak-tested, belts aligned and tensioned, all shipping braces removed, bearing set screws torqued, and fan has been test-run under observation.

1.09 WARRANTY

- A. AHU manufacturer shall provide, at no additional cost, a standard parts warranty that covers a period of one year date of substantial completion. This warrants that all products are free from defects in material and workmanship and shall meet the capacities and ratings set forth in the equipment manufacturer's catalog and bulletins.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturer must clearly define any exceptions made to Plans and Specifications. Any deviations in layout or arrangement shall be submitted to consulting engineer prior to bid date. Acceptance of deviation(s) from specifications shall be in the form of written approval from the consulting engineer. Mechanical Contractor is responsible for expenses that occur due to exceptions made.
- B. Approved Manufacturers:
 - 1. Daikin
 - 2. Trane
 - 3. York
 - 4. Engineer approved equal.

2.02 GENERAL

- A. Unit layout and configuration shall be as defined in project plans and schedule.
- B. Manufacturer to provide an integral base frame to support and raise all sections of the unit for proper trapping. Contractor will be responsible for providing a housekeeping pad when unit base frame is not of sufficient height to properly trap unit. Unit base frames not

constructed of galvanized steel shall be chemically cleaned and coated with both a rust-inhibiting primer and finished coat of rust-inhibiting enamel. Unit base height to be included in trap

2.03 UNIT CASING

- A. Unit manufacturer shall ship unit in segments as specified by the contractor for ease of installation in tight spaces. The entire air handler shall be constructed of galvanized steel. Casing finished to meet ASTM B117 250-hour salt-spray test. The removal of access panels or access doors shall not affect the structural integrity of the unit. All removable panels shall be gasketed. All doors shall have gasketing around full perimeter to prevent air leakage. Contractor shall be responsible to provide connection flanges and all other framework that is needed to properly support the unit.
- B. Casing performance - Casing air leakage shall not exceed leak class 6 (CL = 6) per ASHRAE 111 at specified casing pressure, where maximum casing leakage (cfm/100 ft² of casing surface area) = CL X P^{0.65}.
- C. Air leakage shall be determined at 1.00 times maximum casing static pressure up to 8 inches w.g. Specified air leakage shall be accomplished without the use of caulk. Total estimated air leakage shall be reported for each unit in CFM, as a percentage of supply air, and as an ASHRAE 111 Leakage Class.
- D. Under 55F supply air temperature and design conditions on the exterior of the unit of 81F dry bulb and 73F wet bulb, condensation shall not form on the casing exterior. The AHU manufacturer shall provide tested casing thermal performance for the scheduled supply air temperature plotted on a psychrometric chart. The design condition on the exterior of the unit shall also be plotted on the chart. If tested casing thermal data is not available, AHU manufacturer shall provide, in writing to the Engineer and Owner, a guarantee against condensation forming on the unit exterior at the stated design conditions above. The guarantee shall note that the AHU manufacturer will cover all expenses associated with modifying units in the field should external condensate form on them. In lieu of AHU manufacturer providing a written guarantee, the installing contractor must provide additional external insulation on AHU to prevent condensation.
- E. Unit casing (wall/floor/roof panels and doors) shall be able to withstand up to 1.5 times design static pressure, or 8-inch w.g., whichever is less, and shall not exceed 0.0042 per inch of panel span (L/240).
- F. Floor panels shall be double-wall construction and designed to support a 250-lb load during maintenance activities and shall deflect no more than 0.0042 per inch of panel span.
- G. Unit casing panels shall be 2-inch double-wall construction, with solid galvanized exterior and solid galvanized interior, to facilitate cleaning of unit interior.
- H. Unit casing panels (roof, walls, floor) and doors shall be provided with a minimum thermal resistance (R-value) of 13 Hr*Ft²*F/BTU.
- I. Unit casing panels (roof, walls, floor) and external structural frame members shall be completely insulated filling the entire panel cavity in all directions so that no voids exist. Panel insulation shall comply with NFPA 90A.

- J. Casing panel inner liners must not extend to the exterior of the unit or contact the exterior frame. A mid-span, no-through-metal, internal thermal break shall be provided for all unit casing panels.
- K. Access panels and/or access doors shall be provided in all sections to allow easy access to drain pan, coil(s), motor, drive components and bearings for cleaning, inspection, and maintenance.
- L. Access panels and doors shall be fully removable without the use of specialized tools to allow complete access of interior surfaces.
- M. External surface of unit casing shall be prepared and coated with a minimum 1.5 mil enamel finish or equal. Units supplied with casing exterior factory-painted shall be able to withstand a salt spray test in accordance with ASTM B117 for a minimum of 500 consecutive hours. Unit casing exterior will be provided with manufacturer's standard color, or alternative color when required.
- N. A single layer outer/outdoor roof shall be utilized above the unit's inner roof and shall be sloped at a minimum 0.125 inches per foot either from one side of unit to other, or from center to sides of the unit. The roof assembly shall overhang all walls of units by a 1.5 inch minimum.
- O. Piping cabinets shall be supplied by the manufacturer (factory-assembled) and shall be of the same construction as the main unit casing. Piping cabinet shall be mounted external to the unit and shipped separate to be field installed.

2.04 ACCESS DOORS

- A. Access doors shall be 2-inch double-wall construction. Interior and exterior shall be of the same construction as the interior and exterior wall panels.
- B. All doors shall be provided with a thermal break construction of door panel and door frame.
- C. Gasketing shall be provided around the full perimeter of the doors to prevent air leakage.
- D. Door hardware shall be surface-mounted to prevent through-cabinet penetrations that could likely weaken the casing leakage and thermal performance.
- E. Handle hardware shall be designed to prevent unintended closure.
- F. Access doors shall be hinged and removable without the use of specialized tools to allow.
- G. Hinges shall be interchangeable with the door handle hardware to allow for alternating door swing in the field to minimize access interference due to unforeseen job site obstructions.
- H. Door handle hardware shall be adjustable and visually indicate locking position of door latch external to the section.
- I. All doors shall be a 60-inch high when sufficient unit height is available, or the maximum height allowed by the unit height.

- J. A single door handle shall be provided for each door linking multiple latching points necessary to maintain the specified air leakage integrity of the unit.
- K. A shatterproof window shall be provided in access doors where indicated on the plans.

2.05 PRIMARY DRAIN PANS

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

2.06 FANS

- A. Fan sections shall have a minimum of one hinged and latched access door located on the drive side of the unit to allow inspection and maintenance of the fan, motor, and drive components. Construct door(s) per Section 2.04.
- B. Provide fans of type and class as specified on the schedule. Fan shafts shall be solid steel, coated with a rust-inhibiting coating, and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM. All fans shall be statically and dynamically tested by the manufacturer for vibration and alignment as an assembly at the operating RPM to meet design specifications. Fans that are selected with inverter balancing shall first be dynamically balanced at design RPM. The fans then will be checked in the factory from 25% to 100% of design RPM to ensure they are operating within vibration tolerance specifications, and that there are no resonant frequency issues throughout this operating range. Inverter balancing that requires lockout frequencies inputted into a variable frequency drive in order to bypass resonant frequencies shall not be acceptable. If supplied in this manner by the unit manufacturer, the contractor will

be responsible for rebalancing in the field after unit installation. Fans selected with inverter balancing shall have a maintenance free, circumferential conductive micro fiber shaft grounding ring installed on the fan motor to discharge shaft currents to ground.

- C. Belt-driven fans shall be provided with grease lubricated, self-aligning, anti-friction bearings selected for L-50 200,000-hour average life per ANSI/AFBMA Standard 9. Lubrication lines for both bearings shall be extended to the drive side of the AHU and rigidly attached to support bracket with zerk fittings. Lubrication lines shall be a clear, high-pressure, polymer to aid in visual inspection. If extended lubrication lines are not provided, manufacturer shall provide permanently lubricated bearing with engineering calculations for proof of bearing life.
- D. All fans, including direct drive plenum fans, shall be mounted on isolation bases. Internally-mounted motor shall be on the same isolation base. Fan and motor shall be internally isolated with spring isolators. Unit sizes up to a nominal 4,000 CFM shall have 1-inch spring isolation. Units with nominal CFM's higher than 4,000 shall have 2-inch springs. A flexible connection shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor in order to avoid transmission of noise and vibration through the ductwork and building structure.
- E. Fan airflow measurement systems shall be provided as indicated on the schedule and drawings to measure fan airflow directly or to measure differential pressure that can be used to calculate airflow. The accuracy of the devices shall be no worse than +/- 5 percent when operating within stable fan operating conditions. Devices shall not affect the submitted fan performance and acoustical levels. Devices that obstruct the fan inlet or outlet shall not be acceptable. Devices shall be connected to transducers with selectable 4-20 mA or 2-10 VDC output. Signal shall be proportional to air velocity.
- F. MOTORS AND DRIVES
 1. All motors and drives shall be factory-installed and run tested. All motors shall be installed on a slide base to permit adjustment of belt tension. Slide base shall be designed to accept all motor sizes offered by the air-handler manufacturer for that fan size to allow a motor change in the future, should airflow requirements change. Fan sections without factory-installed motors shall have motors field installed by the contractor. The contractor shall be responsible for all costs associated with installation of motor and drive, alignment of sheaves and belts, run testing of the motor, and balancing of the assembly.
 2. Motors shall meet or exceed all NEMA Standards Publication MG 1 - 2006 requirements and comply with NEMA Premium efficiency levels when applicable. Motors shall comply with applicable requirements of NEC and shall be UL Listed.
 3. Fan Motors shall be heavy duty, open drip-proof operable at 460 volts, 60Hz, 3-phase. If applicable, motor efficiency shall meet or exceed NEMA Premium efficiencies.
 4. Belt driven fans shall use 4-pole, 1800 rpm, motors, NEMA B design, with Class B insulation, capable to operate continuously at 104 deg F (40 deg C) without tripping overloads.
 5. Direct driven fans shall use 2-pole (3600 rpm), 4-pole (1800 rpm) or 6-pole (1200 rpm) motors, NEMA Design B, with Class B insulation capable to operate continuously at 104 deg F (40 deg C) without tripping overloads.

6. Motors shall have a +/- 10 percent voltage utilization range to protect against voltage variation.
7. V-Belt Drive shall be fixed pitch rated at 1.5 times the motor nameplate. Drives 20 hp and larger or any drives on units equipped with VFDs shall be fixed pitch.
8. All fans with motors 15 hp and larger shall be equipped with multiple belt drives.
9. Manufacturer shall provide for each fan a nameplate with the following information to assist air balance contractor in start up and service personnel in maintenance. Fan and motor sheave part number. Fan and motor bushing part number. Number of belts and belt part number. Fan design RPM and motor HP. Belt tension and deflection. Center distance between shafts

2.07 COILS

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

1. Supply and return header connections shall be clearly labeled on unit exterior such that direction of coil water-flow is counter to direction of unit air-flow.
2. Coils shall be proof-tested to 300 psig and leak-tested to 200 psig air pressure under water.
3. Headers shall be constructed of round copper pipe or cast iron.
4. Tubes shall be copper with aluminum fins. Tube thickness and diameter shall be as indicated on plans.
5. Hydronic coils shall be supplied with factory installed drain and vent piping to the unit exterior.

2.08 FILTERS

- A. Provide factory-fabricated filter section of the same construction and finish as unit casings. Filter section shall have side access filter guides and access door(s) extending the full height of the casing to facilitate filter removal. Construct doors in accordance with Section 2.04. Provide fixed filter blockoffs as required to prevent air bypass around filters. Blockoffs shall not need to be removed during filter replacement. Filters to be of size, and quantity needed to maximize filter face area of each particular unit size.
- B. Filter type, MERV rating, and arrangement shall be provided as defined in project plans and schedule
- C. Manufacturer shall provide one set of startup filters.
- D. Each filter section shall be provided with a factory-installed, flush-mounted Dwyer dial-type differential pressure gauge piped to both sides of the filter to indicate status. Gauge shall maintain a +/- 5 percent accuracy within operating temperature limits of -20°F to 120°F. Filter sections consisting of pre- and post-filters shall have a gauge for each.

2.09 DAMPERS

- A. All dampers, shall be internally mounted. Dampers shall be premium ultra low leak and located as indicated on the schedule and plans. Blade arrangement (parallel or opposed) shall be provided as indicated on the schedule and drawings. Dampers shall be Ruskin CD60 double-skin airfoil design or equivalent for minimal air leakage and pressure drop. Leakage rate shall not exceed 4 CFM/square foot at one inch water gauge complying with ASHRAE 90.1 maximum damper leakage and shall be AMCA licensed for Class 1A. All leakage testing and pressure ratings shall be based on AMCA Standard 500-D. Manufacturer shall submit brand and model of damper(s) being furnished, if not Ruskin CD60.
- B. Airflow measuring stations shall be provided and located in the outside and/or return air paths as indicated on the schedule and plans to measure airflow. Airflow measuring stations shall be tested per AMCA Standard 611 and licensed to bear the AMCA Ratings Seal for airflow measurement performance. Integral control damper blades shall be provided as galvanized steel and housed in a galvanized steel frame. Leakage rate shall not exceed 4 CFM/square foot at one inch water gauge complying with ASHRAE 90.1 maximum damper leakage.
 1. The airflow measurement station shall measure up to 100 percent of the total outside air and/or return air. The airflow measurement station shall be capable of measuring down to 300 fpm. The airflow measuring device shall adjust for temperature variations. Output shall be provided from the station as a 2-10 VDC signal. Signal shall be proportional to air velocity. The accuracy of the

measuring station shall be no greater than +/- 5 percent. Airflow measuring stations shall be mounted on the AHU interior.

2. The installing contractor shall provide duct-mounted pleated media MERV 8 filtration upstream of airflow monitoring stations requiring air straightening vanes to prevent blockage of vanes. A filter access door shall be provided for filter replacement that does not degrade the specified duct leakage class. Duct-mounted filtration section with access door for filter removal shall be tested for compliance to specified duct leakage class on the schedule and plans.

2.10 ACCESS SECTIONS

- A. Access sections shall be provided where indicated in the schedule and plans to allow additional access for inspection, cleaning, and maintenance of unit components. The unit shall be installed for proper access. Procedure for proper access, inspection and cleaning of the unit shall be provided in the AHU manufacturer's maintenance manual. Access section doors shall be constructed per Section 2.04.

2.11 AIR MIXER/BLENDER SECTION

- A. Air mixers (blenders) shall be provided and located as indicated on the schedule and drawings. Mixers shall incorporate fixed blades, with no moving parts. Mixer panels shall be sized and installed in the unit with adequate distances upstream and downstream, based on the manufacturer's cataloged performance, to ensure a minimum mixing effectiveness of 70% at 25% outside air, at one mixer diameter downstream of the mixer.

2.12 DISCHARGE PLENUM SECTIONS

- A. Plenums shall be provided as indicated in the schedule and plans to efficiently turn air and provide acoustical attenuation. Discharge plenum opening types and sizes shall be scaled to meet pressure drop requirements scheduled and align with duct takeoffs.

2.13 MARINE LIGHTS

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

PART 3 EXECUTION

3.01 SHIPPING

- A. Paper copies of the IOM shall also be shipped with each AHU.
- B. The AHU manufacturer shall identify all shipments with the order number. Enough information shall be provided with each shipment to enable the Mechanical Contractor to confirm the receipt of units when they are received. For parts too small to mark individually, the AHU manufacturer shall place them in containers.
- C. To protect equipment during shipment and delivery, all indoor units shall be completely stretch or shrink wrapped. Wrap shall be a minimum of 7 mil plastic. Pipe ends and pipe connection holes in the casing shall be capped or plugged prior to shipment
- D. After loading the equipment for shipment, the AHU manufacturer shall contact the shipping contact on the order and provide the name of the carrier, description of equipment, order number, shipping point, and date of shipment.

3.02 ON-SITE STORAGE

- A. If equipment is to be stored for a period of time prior to installation, the Mechanical Contractor shall remove all stretch or shrink wrap from units upon receipt to prevent unit corrosion and shall either place the units in a controlled indoor environment or shall cover the units with canvas tarps and place them in a well-drained area. Covering units with plastic tarps shall not be acceptable.

3.03 FIELD EXAMINATION

- A. The Mechanical Contractor shall verify that the mechanical room and/or roof are ready to receive work and the opening dimensions are as indicated on the shop drawings and contract documents.
- B. The Mechanical Contractor shall verify that the proper power supply is available prior to starting of the fans.

3.04 INSTALLATION

- A. The Mechanical Contractor shall be responsible to coordinate ALL of his installation requirements with the Owner and the Owner's selected Mechanical Contractor to ensure that a complete installation for each unit is being provided. Coordination efforts shall include such items as unloading and hoisting requirements, field wiring requirements, field piping requirements, field ductwork requirements, requirements for assembly of field-bolted or welded joints, and all other installation and assembly requirements.
- B. The AHU manufacturer shall provide all screws and gaskets for joining of sections in the field.
- C. The Mechanical Contractor shall verify that the following items have been completed prior to scheduling the AHU manufacturer's final inspection and start up:
 - 1. All spring-isolated components have had their shipping restraints removed and the components have been leveled.
 - 2. On all field-joined units, that all interconnections have been completed, i.e., electrical and control wiring, piping, casing joints, bolting, welding, etc.
 - 3. All water and steam piping connections have been completed and hydrostatically tested and all water flow rates have been set in accordance with the capacities

- scheduled on the Drawings.
4. All ductwork connections have been completed and all ductwork has been pressure tested for its intended service.
 5. All power wiring, including motor starters and disconnects, serving the unit has been completed.
 6. All automatic temperature and safety controls have been completed.
 7. All dampers are fully operational.
 8. All shipping materials have been removed.
 9. All (clean) filter media has been installed in the units.

3.05 LEVELING

- A. The Mechanical Contractor shall level all unit sections in accordance with the unit manufacturer's instructions. The Mechanical Contractor shall provide and install all necessary permanent shim material to ensure individual sections and entire assembled units are level.

3.06 FINAL INSPECTION AND START UP SERVICE

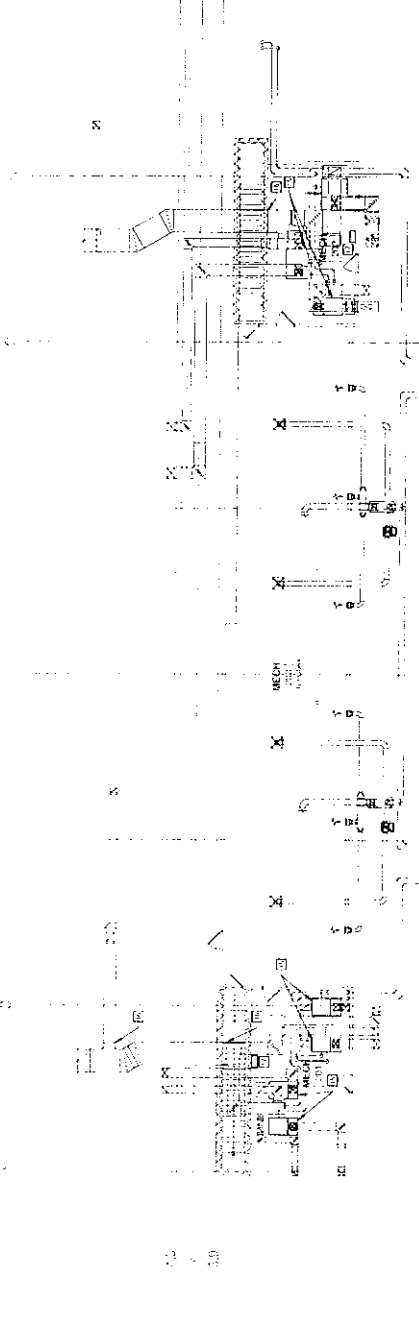
- A. After the Mechanical Contractor has provided all water and steam piping connections, ductwork connections, and field control wiring, and Electrical Contractor has provided all the field power wiring, the Mechanical Contractor shall inspect the installation. The Mechanical Contractor shall then perform startup of the equipment.
- B. The Automatic Temperature Control (Building Direct Digital Control) Contractor shall be scheduled to be at the job site at the time of the equipment start up.
- C. The Mechanical Contractor, shall perform the following tests and services and submit a report outlining the results:
 1. Record date, time, and person(s) performing service.
 2. Lubricate all moving parts.
 3. Check all motor and starter power lugs and tighten as required.
 4. Verify all electrical power connections.
 5. Conduct a start up inspection per the AHU manufacturer's recommendations.
 6. Record fan motor voltage and amperage readings.
 7. Check fan rotation and spin wheel to verify that rotation is free and does not rub or bind.
 8. Check fan for excessive vibration.
 9. Check V belt drive or coupling for proper alignment.
 10. Check V belt drive for proper tension. Tighten the belts in accordance with the AHU manufacturer's directions. Check belt tension during the second- and seventh-day's operation and re-adjust belts, as may be required, to maintain proper tension as directed by the AHU manufacturer.
 11. Remove all foreign loose material in ductwork leading to and from the fan and in the fan itself.
 12. Disengage all shipping fasteners on vibration isolation equipment.
 13. Check safety guards to ensure they are properly secured.
 14. Secure all access doors to the fan, the unit and the ductwork.
 15. Switch electrical supply "on" and allow fan to reach full speed.
 16. Physically check each fan at start up and shut down to ensure no abnormal or problem conditions exist.
 17. Check entering and leaving air temperatures (dry bulb and wet bulb) and simultaneously record entering and leaving chilled water temperatures and flow,

18. steam pressures and flow, and outside air temperature.
Check all control sequences.

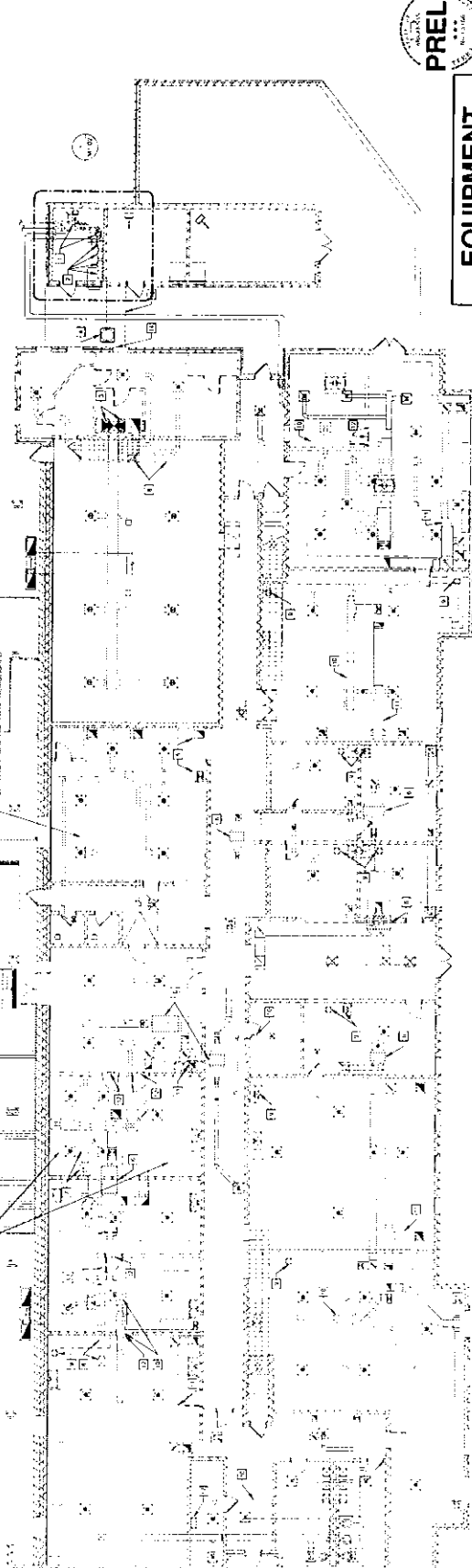
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- HVAC GENERAL DEMOLITION NOTES**
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- HVAC DEMOLITION KEYED NOTES**
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2 LEVEL 2 DEMOLITION PLAN - HVAC
SCALE 1/4\"/>



1 LEVEL 1 DEMOLITION PLAN - HVAC
SCALE 1/4\"/>

H+N ARCHITECTS

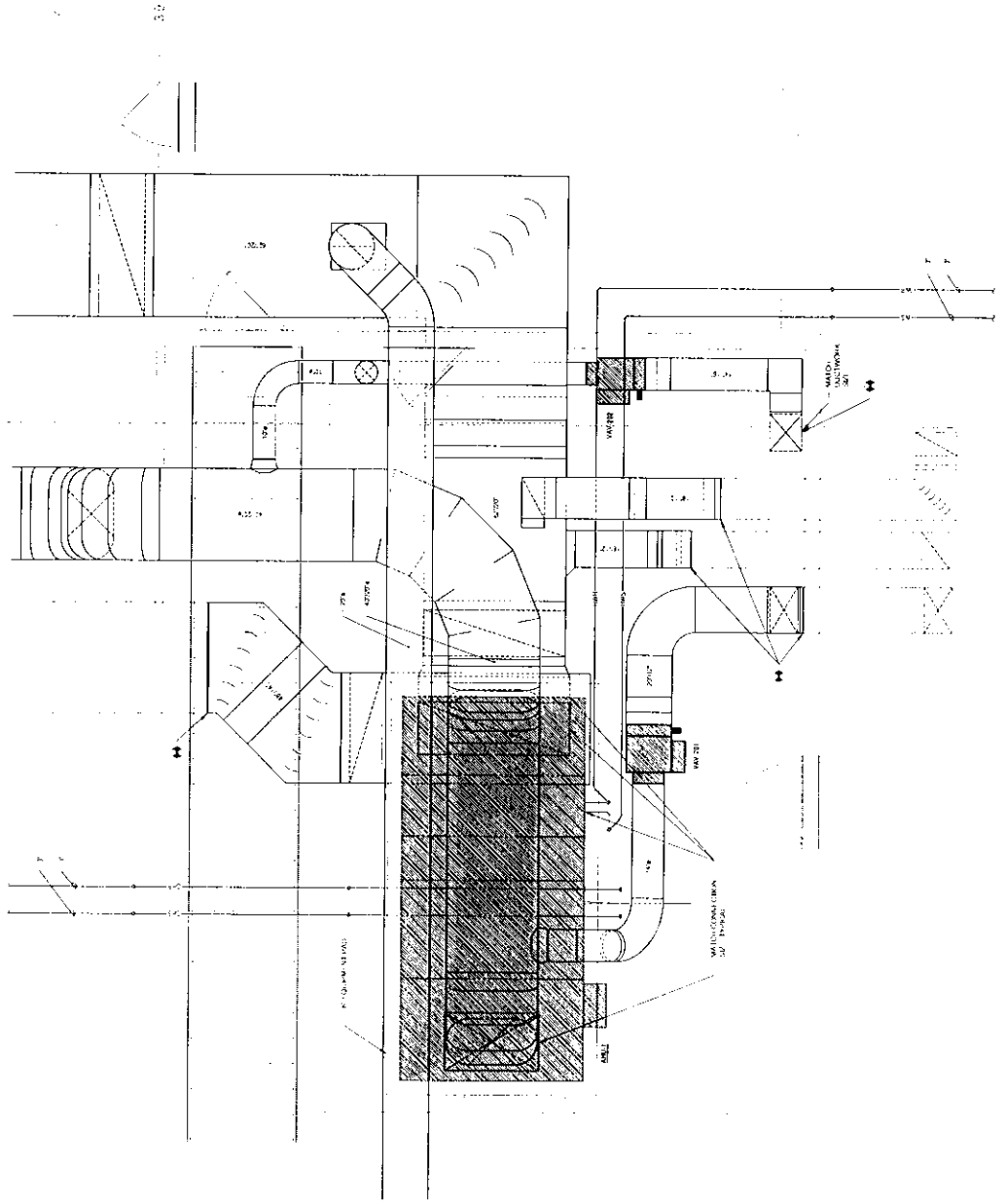
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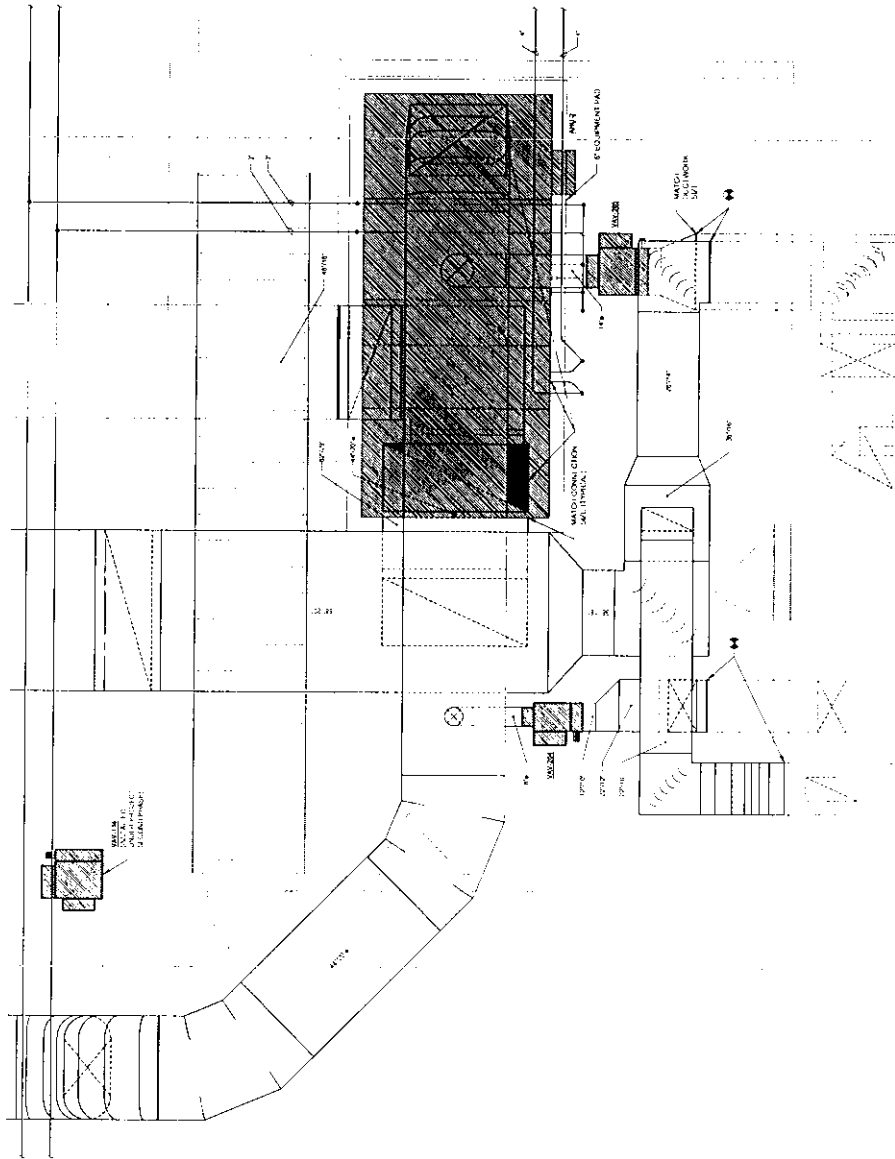
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APPROVED BY: [Name]

**EQUIPMENT
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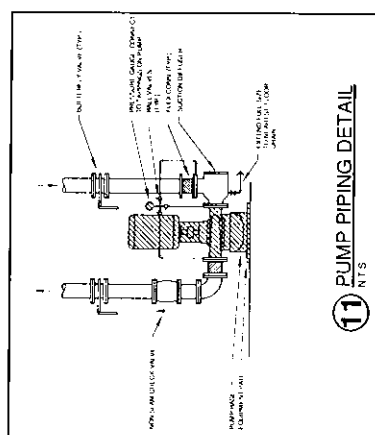
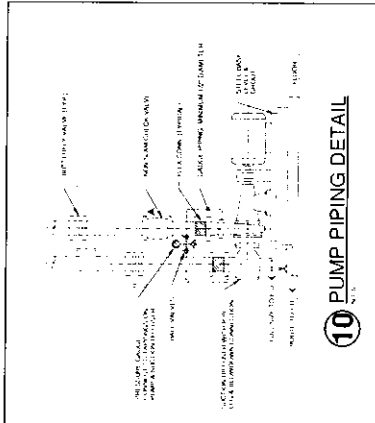
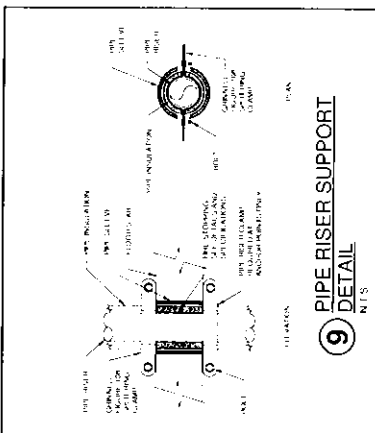
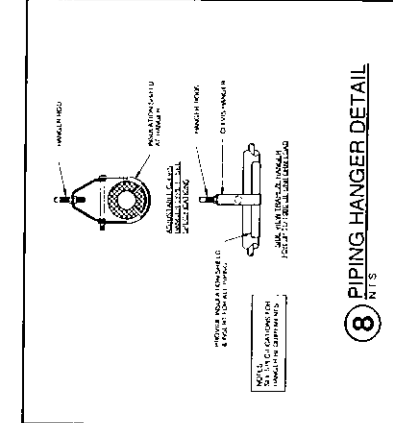
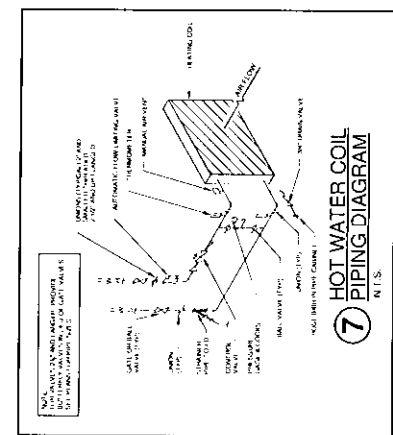
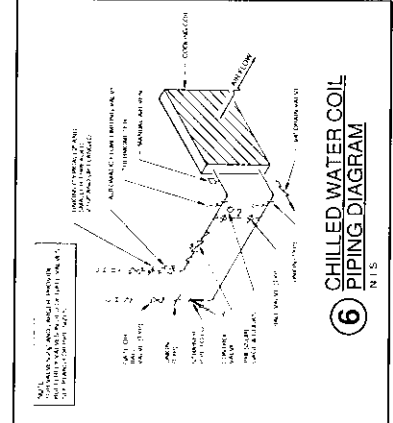
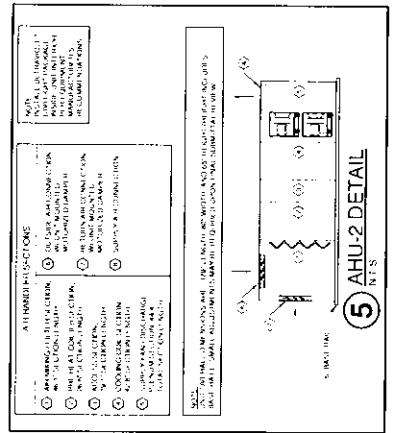
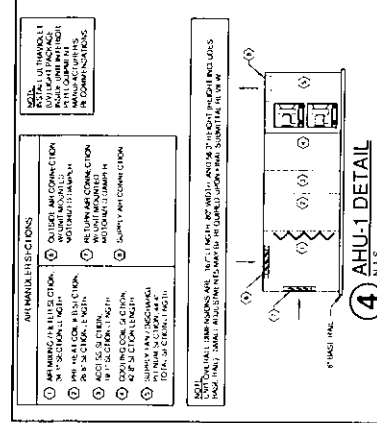
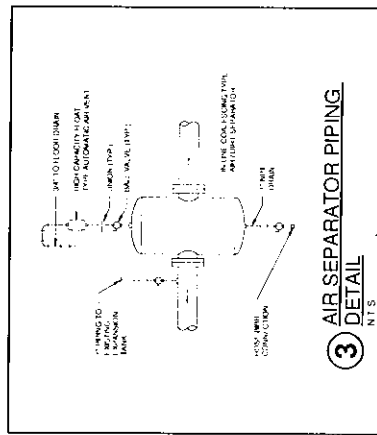
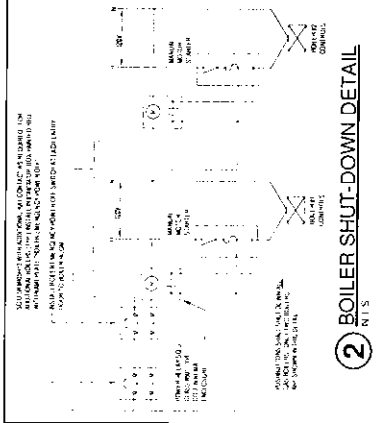
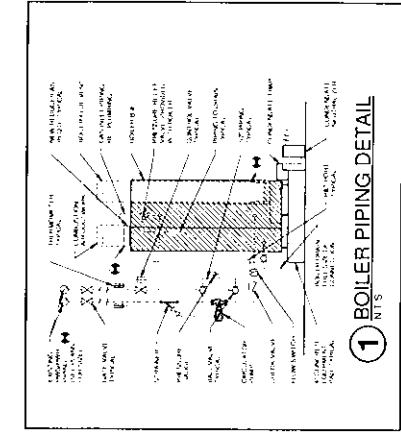


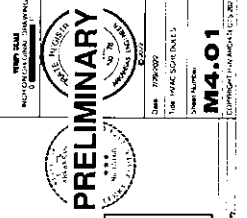
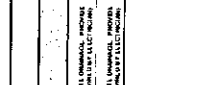
1 LEVEL 2 ENLARGED WEST MECH. ROOM PLAN - HVAC
 SCALE: 1/2" = 1'-0"

EQUIPMENT
PROCUREMENT
PACKAGE



1 LEVEL 2 ENLARGED EAST MECH. ROOM PLAN - HVAC
SCALE: 1/4" = 1'-0"





AIR HANDLING UNIT SCHEDULE

| DESIG. | MFR/MDL | LOCAT. | TYPE | LENGTH | WIDTH | HEIGHT | WEIGHT | OSA | FAN DATA | PRE-HEATING WATER COIL | CHILLED WATER COIL | MOTOR DATA | REMARKS | | | | | | | | | | | | |
|--------|------------|-----------|--------------|--------|-------|--------|--------|-----|----------|------------------------|--------------------|------------|---------|---------|--------|---------|--------|---------|-----|-------|------|-----|-------|------|-----|
| | | | | | | | | | CFM | ESP/SP | TYPE | DA. | W.P.D. | ROW/FIN | W.P.D. | ROW/FIN | W.P.D. | ROW/FIN | HP | PHASE | AMPA | HP | PHASE | AMPA | |
| NAV-01 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-02 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-03 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-04 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-05 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-06 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-07 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-08 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-09 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-10 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-11 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-12 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-13 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-14 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-15 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-16 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-17 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-18 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-19 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-20 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-21 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-22 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-23 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-24 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| NAV-25 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 10' | 10' | 10' | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

EXHAUST FAN SCHEDULE

| DESIG. | MFR/MDL | LOCAT. | TYPE | HP | PHASE | AMPA | REMARKS |
|--------|---------|-----------|--------------|-----|-------|------|---------|
| E-01 | ORNL/CH | MECH-ROOF | ROOF EXHAUST | 1.0 | 3 | 1.7 | 1.0 |

HOT WATER BOILER SCHEDULE

| DESIG. | MFR/MDL | TYPE | FUEL | INPUT MBH | OUTPUT MBH | EFF. | HP | PHASE | AMPA | REMARKS |
|--------|---------|-------|-------------|-----------|------------|------|-----|-------|------|---------|
| B-1 | WATERS | WATER | NATURAL GAS | 100 | 100 | 85 | 1.0 | 3 | 1.7 | 1.0 |
| B-2 | WATERS | WATER | NATURAL GAS | 100 | 100 | 85 | 1.0 | 3 | 1.7 | 1.0 |

PUMP SCHEDULE

| DESIG. | MFR/MDL | LOCAT. | TYPE | HP | PHASE | AMPA | REMARKS |
|--------|---------|-----------|-------|-----|-------|------|---------|
| P-1 | WATERS | MECH-ROOF | WATER | 1.0 | 3 | 1.7 | 1.0 |
| P-2 | WATERS | MECH-ROOF | WATER | 1.0 | 3 | 1.7 | 1.0 |
| P-3 | WATERS | MECH-ROOF | WATER | 1.0 | 3 | 1.7 | 1.0 |

AIR / DIRT SEPARATOR SCHEDULE

| DESIG. | MFR/MDL | TYPE | SERVES | SYSTEM FLOW | PRESS. DROP | VOLUME | INLET CONNECTIONS | OUTLET CONNECTIONS | WEIGHT | REMARKS |
|--------|---------|-----------|--------|-------------|-------------|--------|-------------------|--------------------|--------|---------|
| S-1 | WATERS | MECH-ROOF | WATER | 1.0 | 3 | 1.7 | 1.0 | 3 | 1.7 | 1.0 |

ULTRAVIOLET (UV) LIGHTING SCHEDULE

| DESIG. | MFR/MDL | TYPE | UNIT SERVED | QUANTITY | ROWS | COLUMNS | VOLTS | AMPS | PHASE | REMARKS |
|--------|---------|-----------|-------------|----------|------|---------|-------|------|-------|---------|
| UV-1 | WATERS | MECH-ROOF | WATER | 1.0 | 3 | 1.7 | 1.0 | 3 | 1.7 | 1.0 |

HEATING WATER COIL DATA

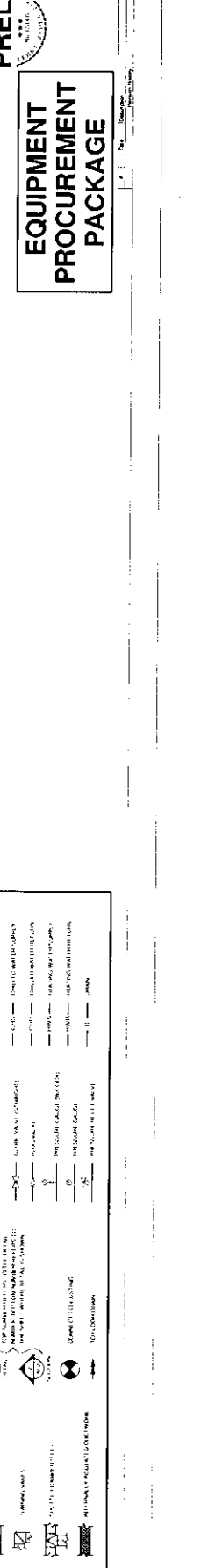
| DESIG. | MFR/MDL | LOCAT. | TYPE | CFM | ESP/SP | TYPE | DA. | W.P.D. | ROW/FIN | REMARKS |
|--------|------------|-----------|--------------|-----|--------|------|-----|--------|---------|---------|
| HWC-01 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

PRE-HEATING WATER COIL

| DESIG. | MFR/MDL | LOCAT. | TYPE | CFM | ESP/SP | TYPE | DA. | W.P.D. | ROW/FIN | REMARKS |
|--------|------------|-----------|--------------|-----|--------|------|-----|--------|---------|---------|
| PWC-01 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

AIR TERMINAL BOX SCHEDULE

| DESIG. | MFR/MDL | TYPE | PRIMARY SIZE | ADJ. SIZE | CFM | MIN. W.P.D. | MAX. W.P.D. | ROW/FIN | REMARKS |
|--------|------------|-----------|--------------|-----------|-----|-------------|-------------|---------|---------|
| AT-01 | THANK VIEW | MECH-ROOF | ROOF EXHAUST | 100 | 100 | 100 | 100 | 100 | 100 |



EQUIPMENT PROCUREMENT PACKAGE

EXPANSION TANK SCHEDULE

| DESIG | MFANGL | SERVS | LOCAT | TYPE | SYSTEM VOLUME | MINIMUM TEMPERATURE | MAXIMUM TEMPERATURE | INITIAL TANK AIR PRESSURE | MAXIMUM TANK PRESSURE | MINIMUM TANK SIZE | MINIMUM ACCEPTANCE | TANK DIMENSIONS | REMARKS |
|-------|--------|-------|-------|------|---------------|---------------------|---------------------|---------------------------|-----------------------|-------------------|--------------------|-----------------------|---|
| 111 | | | | | 100 GAL | 40 °F | 100 °F | 24 PSIG | 88 PSIG | 20 GAL | 20 GAL | 36" x 48" x 36" TAPER | INSTALL TANK, FIELD W/ACCEPTABLE BLAST-PROOF INSULATION |

VARIABLE FREQUENCY DRIVE SCHEDULE

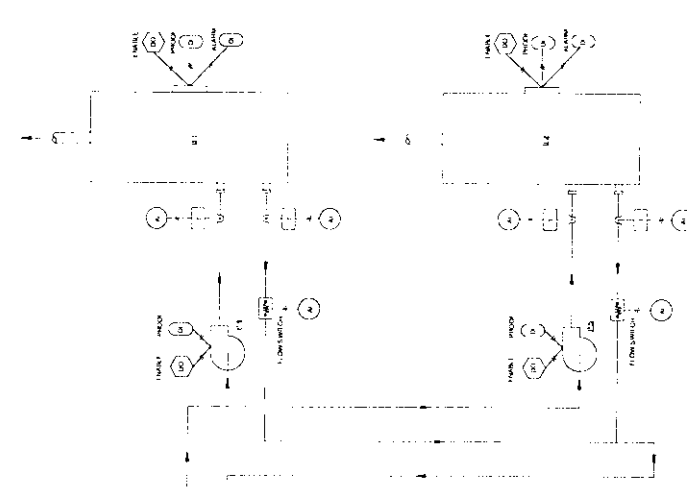
| DESIGNATION | SERVS | MFANGL | TYPE | APPLICATION | RATED HORSEPOWER | VOLTAGE | PHASE | AMPS | MINIMUM EFFICIENCY | REMARKS |
|-------------|-------|--------------|--------------|--------------------------|------------------|---------|-------|------|--------------------|---|
| VF1 | PUMP | WALL MOUNTED | WALL MOUNTED | VARIABLE FREQUENCY DRIVE | 7.5 | 208 | 3 | 24.2 | 94% | INSTALL VFD TO MANAGE VERTICAL BRINES (LOCAL AREA) APPROXIMATELY 17500 GPM. APPROXIMATELY 1000 GPM. APPROXIMATELY 1000 GPM. APPROXIMATELY 1000 GPM. |
| VF2 | PUMP | WALL MOUNTED | WALL MOUNTED | VARIABLE FREQUENCY DRIVE | 15 | 208 | 3 | 24.2 | 94% | INSTALL VFD TO MANAGE VERTICAL BRINES (LOCAL AREA) APPROXIMATELY 17500 GPM. APPROXIMATELY 1000 GPM. APPROXIMATELY 1000 GPM. APPROXIMATELY 1000 GPM. |
| VF3 | PUMP | WALL MOUNTED | WALL MOUNTED | VARIABLE FREQUENCY DRIVE | 15 | 208 | 3 | 24.2 | 94% | INSTALL VFD TO MANAGE VERTICAL BRINES (LOCAL AREA) APPROXIMATELY 17500 GPM. APPROXIMATELY 1000 GPM. APPROXIMATELY 1000 GPM. APPROXIMATELY 1000 GPM. |
| VF4 | PUMP | WALL MOUNTED | WALL MOUNTED | VARIABLE FREQUENCY DRIVE | 15 | 208 | 3 | 24.2 | 94% | INSTALL VFD TO MANAGE VERTICAL BRINES (LOCAL AREA) APPROXIMATELY 17500 GPM. APPROXIMATELY 1000 GPM. APPROXIMATELY 1000 GPM. APPROXIMATELY 1000 GPM. |
| VF5 | PUMP | WALL MOUNTED | WALL MOUNTED | VARIABLE FREQUENCY DRIVE | 15 | 208 | 3 | 24.2 | 94% | INSTALL VFD TO MANAGE VERTICAL BRINES (LOCAL AREA) APPROXIMATELY 17500 GPM. APPROXIMATELY 1000 GPM. APPROXIMATELY 1000 GPM. APPROXIMATELY 1000 GPM. |
| VF6 | PUMP | WALL MOUNTED | WALL MOUNTED | VARIABLE FREQUENCY DRIVE | 15 | 208 | 3 | 24.2 | 94% | INSTALL VFD TO MANAGE VERTICAL BRINES (LOCAL AREA) APPROXIMATELY 17500 GPM. APPROXIMATELY 1000 GPM. APPROXIMATELY 1000 GPM. APPROXIMATELY 1000 GPM. |
| VF7 | PUMP | WALL MOUNTED | WALL MOUNTED | VARIABLE FREQUENCY DRIVE | 15 | 208 | 3 | 24.2 | 94% | INSTALL VFD TO MANAGE VERTICAL BRINES (LOCAL AREA) APPROXIMATELY 17500 GPM. APPROXIMATELY 1000 GPM. APPROXIMATELY 1000 GPM. APPROXIMATELY 1000 GPM. |
| VF8 | PUMP | WALL MOUNTED | WALL MOUNTED | VARIABLE FREQUENCY DRIVE | 15 | 208 | 3 | 24.2 | 94% | INSTALL VFD TO MANAGE VERTICAL BRINES (LOCAL AREA) APPROXIMATELY 17500 GPM. APPROXIMATELY 1000 GPM. APPROXIMATELY 1000 GPM. APPROXIMATELY 1000 GPM. |
| VF9 | PUMP | WALL MOUNTED | WALL MOUNTED | VARIABLE FREQUENCY DRIVE | 15 | 208 | 3 | 24.2 | 94% | INSTALL VFD TO MANAGE VERTICAL BRINES (LOCAL AREA) APPROXIMATELY 17500 GPM. APPROXIMATELY 1000 GPM. APPROXIMATELY 1000 GPM. APPROXIMATELY 1000 GPM. |
| VF10 | PUMP | WALL MOUNTED | WALL MOUNTED | VARIABLE FREQUENCY DRIVE | 15 | 208 | 3 | 24.2 | 94% | INSTALL VFD TO MANAGE VERTICAL BRINES (LOCAL AREA) APPROXIMATELY 17500 GPM. APPROXIMATELY 1000 GPM. APPROXIMATELY 1000 GPM. APPROXIMATELY 1000 GPM. |

THIS SCHEDULE IS PRELIMINARY. ALL VOLTAGE, PHASE, AND AMPERAGE VALUES ARE SUBJECT TO CHANGE WITH THE FINAL CONTRACT DOCUMENTS.

INDUSTRIAL EQUIPMENT
PRELIMINARY
DATE: 1/20/2022
DRAWN BY: J. H. HANCOCK
CHECKED BY: J. H. HANCOCK
SCALE: AS SHOWN

**EQUIPMENT
PROCUREMENT
PACKAGE**

M4.02
CONWAY, ARKANSAS

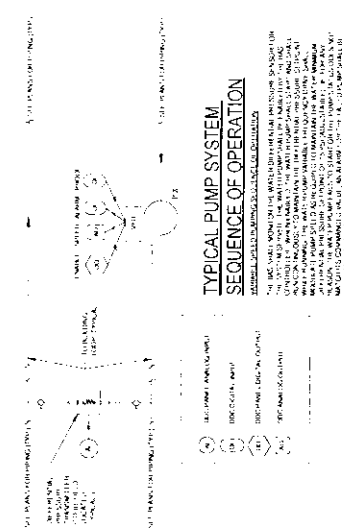


**HEATING HOT WATER SYSTEM
 SEQUENCE OF OPERATION**

1. THE BOILER IS OPERATED BY THE BOILER CONTROL PANEL. THE BOILER WATER IS PUMPED TO THE HEATING HOT WATER SYSTEM BY THE BOILER PUMP. THE BOILER WATER IS PUMPED TO THE HEATING HOT WATER SYSTEM BY THE BOILER PUMP. THE BOILER WATER IS PUMPED TO THE HEATING HOT WATER SYSTEM BY THE BOILER PUMP.

2. THE HEATING HOT WATER SYSTEM IS OPERATED BY THE HEATING HOT WATER SYSTEM CONTROL PANEL. THE HEATING HOT WATER SYSTEM IS OPERATED BY THE HEATING HOT WATER SYSTEM CONTROL PANEL. THE HEATING HOT WATER SYSTEM IS OPERATED BY THE HEATING HOT WATER SYSTEM CONTROL PANEL.

3. THE HEATING HOT WATER SYSTEM IS OPERATED BY THE HEATING HOT WATER SYSTEM CONTROL PANEL. THE HEATING HOT WATER SYSTEM IS OPERATED BY THE HEATING HOT WATER SYSTEM CONTROL PANEL. THE HEATING HOT WATER SYSTEM IS OPERATED BY THE HEATING HOT WATER SYSTEM CONTROL PANEL.



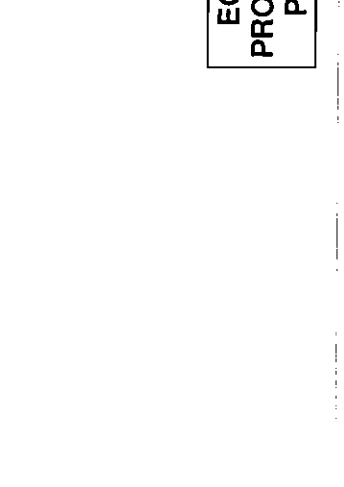
1 TYPICAL PUMP P-X SYSTEM CONTROL DIAGRAM

1. THE TYPICAL PUMP P-X SYSTEM IS OPERATED BY THE TYPICAL PUMP P-X SYSTEM CONTROL PANEL. THE TYPICAL PUMP P-X SYSTEM IS OPERATED BY THE TYPICAL PUMP P-X SYSTEM CONTROL PANEL. THE TYPICAL PUMP P-X SYSTEM IS OPERATED BY THE TYPICAL PUMP P-X SYSTEM CONTROL PANEL.

2. THE TYPICAL PUMP P-X SYSTEM IS OPERATED BY THE TYPICAL PUMP P-X SYSTEM CONTROL PANEL. THE TYPICAL PUMP P-X SYSTEM IS OPERATED BY THE TYPICAL PUMP P-X SYSTEM CONTROL PANEL. THE TYPICAL PUMP P-X SYSTEM IS OPERATED BY THE TYPICAL PUMP P-X SYSTEM CONTROL PANEL.

3. THE TYPICAL PUMP P-X SYSTEM IS OPERATED BY THE TYPICAL PUMP P-X SYSTEM CONTROL PANEL. THE TYPICAL PUMP P-X SYSTEM IS OPERATED BY THE TYPICAL PUMP P-X SYSTEM CONTROL PANEL. THE TYPICAL PUMP P-X SYSTEM IS OPERATED BY THE TYPICAL PUMP P-X SYSTEM CONTROL PANEL.

2 HEATING WATER SYSTEM CONTROL DIAGRAM



**EQUIPMENT
 PROCUREMENT
 PACKAGE**



DATE: 1/10/2019
 REV: HVAC CONTROLS
 MS.02