Evansville Parks and Recreation

Swonder Ice Arena
Rooftop Unit Replacement
Scope of Work

ISSUED FOR BID
July 14, 2025

Prepared by:

THREE i DESIGN
ENGINEERING + ARCHITECTURE

VENDOR INSTRUCTIONS

1. INTRODUCTION

A. The Board of Park Commissioners (the “Board”) for Swonder Ice Arena (the “Owner”) and the City of Evansville (the "City"), is soliciting competitive sealed bids from qualified contractors to replace **rooftop units #1, #4, #5, #6, #7, #8, #9 & #10 at Swonder Ice Arena.**

B. Your company, among others, is invited to submit a bid on a competitive basis in the format described. The bid documents establish requirements and define responsibilities of the proposing vendor (hereinafter "Vendor,” “Respondent,” or “Contractor”) to replace rooftop units #1, #4, #5, #6, #7, #8 #9 & #10 at Swonder Ice Arena

2. GENERAL REQUIREMENTS

The responsibilities of the Contractor include, but shall not be limited to, the following:

A. The Contractor shall purchase all items needed to provide services.

B. The Contractor will furnish all tools and labor required for service.

C. The Contractor shall coordinate with Andrea’ Lord, Swonder Ice Arena Assistant Facility Manager (email: alord@evansville.in.gov or phone: (812)436-5712. for time and space to complete all work required.

D. Contractor will be responsible for any needed traffic control (vehicular and/or pedestrian) during construction.

E. Contractor must possess the required local licensing (Roofing, Electrical, and any others that pertain to work on this project at the time of bid opening, per Evansville Municipal Code 3.95.030.

F. Prime Contractors are required to be designated as a Responsible Bidder at the time of bid submission for any bid over $150,000 per Evansville Municipal Code 3.95.040. Submittal requirements of subcontractors may be provided immediately after bid award, but prior to the execution of a contract.

G. Contractor must have a written drug testing program in place at the time of bid submission for any bid over $10,000 per Evansville Municipal Code 3.95.020.

H. Awarded Contractor must carry the required insurance throughout the bidding process until completion of this project listed in the General Conditions.

3. RESPONSE INSTRUCTIONS

The submitted bid must follow the rules and format established within this Invitation to Bid. Adherence to these rules will ensure a fair and objective analysis of all quotes. Failure to complete any portion of this request may result in rejection of a bid.

4. Pre-Bid Conference

A Mandatory Pre-bid Conference will be conducted on August 5th, 2025 at 10:00am, local time. All

prospective bidders must attend this conference and will be deemed unresponsive if not represented.

5. CONTACT WITH MUNICIPALITY EMPLOYEES

To ensure a fair and objective evaluation of all bids, Vendors are required to submit all inquiries in writing to Andrea' Lord, Swonder Ice Arena Assistant Facility Manager at her email alord@evansville.in.gov. The email should be titled: **Swonder Ice Arena Rooftop Unit Remaining Old Units Replacement**

Inquiries shall be submitted no later than eight (8) days prior to the stated opening time and date. This is to allow for ample time to respond and disseminate to all perspective parties.

All changes in specifications shall be in writing in the form of an addendum and furnished to all contractors. Verbal information obtained otherwise will not be considered in awarding of quotes. No changes to specifications will be permitted within seven (7) days prior to the quote opening.

6. ACCESS BID DOCUMENTS

Before submitting a bid, vendors shall examine the specifications in order to understand all existing conditions and limitations.

7. COSTS OF BID PREPARATION AND SUBMISSION

Each vendor shall be responsible for all costs incurred in order to prepare and submit their response to this IFB.

8. BID BOND

A. Each bid shall be accompanied (in the same envelope) by a bid bond or certified check, made payable to the "CITY OF EVANSVILLE", in an amount equal to five percent (5%) of the total bid submitted.

   No bid may be withdrawn after the opening of bid without the consent of the Evansville Board of Parks Commissioner for a period of thirty (30) days after the scheduled time of opening bids.

9. PUBLIC OPENING PROCEDURES

A. No award will be made or implied at this time, unless otherwise indicated.

B. Only the following information will be given:
   - Vendor name and amount of bid

C. Bids or related documents may not be reviewed at the bid opening. No discussion of any nature concerning brand names, deliveries, samples, etc. can be entered into between any Purchasing Department personnel and any Vendor during or after the bid opening until the evaluation of bids have been completed and a recommendation for award has been made.

D. A copy of the bid tabulation will be available to review in the Purchasing Department upon completion of the recommended award.

E. Vendors who wish to review or request copies of bids may do so by contacting the Purchasing

Department at 812-436-4917. A copy fee will be charged for copies.

10. ACCESS TO PUBLIC RECORDS

A. All submissions may be considered public documents under applicable laws and may be subject to disclosure. Some bid records are public as soon as received by the City, others become public at bid opening, and others at bid award. Contractor recognize and agree that City will not be responsible or liable in any way for any losses that the Contractor may suffer from the lawful disclosure of information or materials to third parties.

B. Any materials requested to be treated as confidential documents, proprietary information, or trade secrets must be clearly identified and readily separable from the balance of the bid submission. Such designations will not necessarily be conclusive, and Contractor may be required to justify why such material should not, upon written request, be disclosed by the City under the applicable public records act.

C. City will endeavor to provide at least two (2) business days' notice to the Contractor of a public records request for material submitted pursuant to this IFB (Invitation for Bid). The City will then release the document in accordance with the City's policy for responding to such requests unless both of the following are true:
   i. the Contractor responds to the notice with any objection to the production of the document within two (2) business days of receipt of the notice; and
   ii. the Contractor agrees in writing to indemnify City, in a form acceptable to City, in the event a challenge is brought for withholding a public record based on Contractor having designated it a trade secret.

11. BID FORMAT AND FORMS

Each bid will be prepared in the format specified, incorporating the additional forms provided at the end of this document, and be submitted in a **sealed** envelope.

The bidder shall give the unit prices in both written form and numerical form for each item. In the event of a discrepancy between written prices and numerical prices the written price form will take precedence and will be used in computing the total project cost.

Submit one (1) original and one (1) electronic copy on a flash drive in a Windows-compatible and searchable format such as PDF. Bids must be clear, concise, typewritten, and must be signed in ink by the official authorized to bind the submitter to its provisions.

The contents of this bid will become incorporated within any contract signed by the Board and the provider of service. Do not retype this bid. Instead, respond on a separate page and cite the section number for each response. All areas of the request must be addressed in the same sequence cited in the Bid instructions in order that proper consideration is given to the bid. ***Bids submitted without information or incomplete content will result in the bid being removed from consideration.***

12. DELIVERY OF BIDS

The submittals must be sealed and clearly labeled:

IFB-512-01-24:Swonder Ice Areana – Rooftop Units #1, #4, #5, #6, #7, #8, #9 & #10 Replacement
Purchasing Department
1 NW Martin Luther King, Jr. Blvd, Room 323

Evansville, Indiana 47708
Bid Open Date: September 3rd, 2025

It is the sole responsibility of the vendor to see that their bid is received in the proper time. Any bids received after the bid opening date and time shall be eliminated from consideration and returned to the Vendor unopened.

Bids must be delivered by 11:45am CDT on September 3rd, 2025 to the following address:

Purchasing Department
1 NW Martin Luther King, Jr. Blvd, Room 323
Evansville, Indiana 47708

NOTE: Any bids submitted after 11:45am on September 3rd, 2025, but before the scheduled opening at 12:00 PM CDT shall be delivered to City Council Chambers, Room 301, 1 NW Martin Luther King Jr. Blvd., Evansville, Indiana 47708.

BID EVALUATION

1. EVALUATIONS

The bid selected shall be the lowest responsive and responsible bidder that provides the most comprehensive approach that meets the stated requirements. The Board reserves the right to award on a line-item basis.

2. RIGHT TO DISCUSSIONS

The agency reserves the right to conduct discussions with Respondents for the purpose of clarification to assure full understanding of, and responsiveness to, the solicitation requirements. The agency further reserves the right to excuse technical defects in a bid when, in its sole discretion, such excuse is beneficial to the agency

.

3. RIGHT OF REFUSAL

The Board reserves the right to reject any one or all bids, or any part of any bid, to waive any informality in any bid, and to award the purchase in the best interest of the Board /City. Furthermore, the City reserves the right to hold the bid of the three (3) lowest Vendors for a period of sixty (60) calendar days from and after the time of the bid opening.

4. AWARD OF CONTRACT

It is the intent of the Board to enter into a contract with a provider that will emphasize administrative efficiencies, and possess the capacity, infrastructure and organizational competence to perform required functions necessary for managed care under this bid.

Award recommendations are contingent upon an initial evaluation of the Contractor's qualifications to determine if the Contractor is a quality service provider. The Contractor's policies and procedures may be evaluated as a further determination of quality.

The process of evaluating each Contractor's bid may involve interviews with a random sampling of the Contractor's current and previous customers. This is not an exclusive criterion for awarding the contract.

It is anticipated that contract(s) will be awarded on or before **September 17th, 2025.**

5. SUBCONTRACTORS

The Board intends to contract with one prime Contractor who will be solely responsible for contractual performance. In the event the prime Contractor utilizes one or more subcontractors, the prime Contractor will assume any and all responsibility for performance of services by the subcontractor(s). Additionally, the City of Evansville must be named as a third-party beneficiary in all subcontracts.

A list of all subcontractors proposed to take part in the performance of the contract must be provided to the City of Evansville for approval prior to contract execution. This request may require that sufficient financial or background information pertaining to included subcontractors be provided.

The City of Evansville reserves the right to limit and/or reject any and all subcontractors.

6. E-VERIFY PROGRAM

Pursuant to Indiana Code 22-5-1.7-11 (b)(2) the Contractor shall provide documentation that it has enrolled and is participating in the E-Verify Program (see Indiana Legal Employment Declaration form). Contractor is required to submit proof from the E-Verify Program that it is currently enrolled in the Program. An example of confirmation is the confirmation e-mail received from E-Verify that the Contractor has successfully enrolled in E-Verify.

7. TAXES

The City of Evansville is exempt from federal, state, and local taxes and will not be responsible for any such taxes in connection with the award or performance of this contract.

8. LICENSES AND PERMITS

The successful Vendor or Vendors shall furnish the City of Evansville upon request any and all documentation regarding licenses, permits, certifications and/or registrations required by the laws and regulations of the City of Evansville, Vanderburgh County, the State of Indiana and the United States of America.

The Provider certifies that it is now and will remain in good standing with the aforementioned governmental agencies and that it will maintains its licenses, permits, certifications and/or registrations in force during the term of the contract/agreement with the City of Evansville, Vanderburgh County, Indiana.

9. CHOICE OF LAW AND VENUE

Any and all actions or proceedings arising out of, or related to, this bid and any resulting contract shall be governed by and construed in accordance with the laws of the State of Indiana. Submission of this bid by Vendor constitutes consent and stipulation to jurisdiction and venue in the courts of Vanderburgh County, Indiana, concerning all litigation and proceedings arising out of or related to this bid and any resulting contract.

10. CONTRACTOR'S ACKNOWLEDGMENT

The Contractor shall comply with the provisions as set forth in Indiana Code § 5-16-13, et al. as required by Indiana Code § 5-16-13-7. Additionally, Contractor shall execute the attached "Contractor's Acknowledgement" and return to Owner prior to the commencement of any Work.

SPECIFICATIONS A

Specifications for replacing Rooftop Unit #2 & #3 of Swonder Ice Arena

1. LENGTH OF CONTRACT

The Contract shall be awarded by action of The Evansville Board of Parks Commissioners

The Board of Park Commissioners shall furnish the Bidder receiving award with a notice of award and three signed copies of the contract. The Contractor shall sign all three copies, returning two to the Evansville Board of Public Commissioners along with the required Proof of Insurance. The Contractor shall have Ten (10) Calendar Days from the notice of award to submit all required documents to execute this contract. If all requirements are not met within the specified time period, the Contractor's Bid Bond accompanying this bid, and the proceeds thereof, shall be paid into the general fund of the City of Evansville, unless a mutual resolution is met by both parties due to an unforeseen incident involving this bid. When all these requirements have been met, the Department of Parks and Recreation may issue the Contractor a notice to proceed. The Contractor shall commence work within ten (10) days after issuance of the notice to proceed.

The Contractor shall be required to guarantee the improvements for a period of three (3) years from the date of final acceptance against all defects in materials and workmanship and shall agree that during the guarantee period specified they will, at own expense, make all repairs which may become necessary.

In case repairs become necessary, the Owner shall give written notice to the Contractor to make the repairs. In case of failure of the Contractor to commence the repairs within ten (10) days after notice, the Owner may cause the repairs to be made, and may thereupon recover the reasonable cost of the repairs so made from the Contractor, together with the cost of the supervision and inspection thereof.

The Owner shall have ninety (90) days after the expiration of the guarantee period in which to notify the Contractor of any repairs necessary on the date of expiration.

1.0 General Notes and Specifications

Contractor shall provide all material, labor, insurance, supervision, safety supplies, safety awareness, and all else required to install all components necessary to prepare the area for the rooftop unit installation as outlined by this Scope of Work. This project shall consist of all demolition, HVAC, temperature controls, BAS upgrades, electrical, steel, and paint work as required for the project according to the information provided. The installation shall be performed according to this document and specifications mentioned herein, including, but not limited to, the following:

1.1 Contractor shall adhere to all applicable specifications and standards, including but not limited to the following:

- Indiana Mechanical Code.
- Indiana Plumbing Code.
- Indiana Electrical Code.
- Indiana Building Code.
- OSHA Standards.
- NFPA Standards.
- SMACNA Standards.
- Local Authorities Having Jurisdiction

All latest editions of the above.

Whenever any of the above standards identify different levels of performance for a given requirement, the standard that produces the most stringent expectations shall apply.

1.2 It shall be the responsibility of the Contractor to visit the site and become familiar with the physical layout of the area where the work is to be performed and to request any additional information and/or data as required satisfying him/herself as to the existing conditions. It is also the Contractor's responsibility to review the specifications and Scope of Work and become cognizant of all the work required. Failure to observe this requirement shall not be cause for a price increase once the Contractor is selected.

1.3 If any unforeseen condition arises, not specifically covered by this Scope of Work, final agreement shall be resolved between the Owner and the Contractor, in writing, before any work is performed. All extra work must be authorized by an "Extra Work Request Form" containing the Contractor's quoted price and a description of the extra work to be performed. The Contractor shall not perform extra work unless he/she has received a signed, “Extra Work Request Form”.

1.4 Quoted prices shall include all: fabrication, procurement, equipment, materials, labor, premium time payment, competent and experienced supervision, clerical and field help, tools and equipment, applicable taxes, insurance, inspection fees, overhead and profit required for a complete job in the specified time.

1.5 Any equipment, materials or services not specifically described in the Scope of Work, but which may be necessary to complete the work for the use intended or in the manner described, shall be within the Scope of the Contractor's work and is construed to be included in the quoted price.

1.6 Contractor shall be responsible for maintaining the agreed upon Project Schedule unless delayed by unforeseen reasons. If the Contractor is stopped for any unforeseen reason, he/she must obtain verification of the delay in writing from the person causing the delay. A brief description of the nature of the delay, the time and date of the delay and the signature of the person causing the delay, will serve as verification.

1.7 Materials and Equipment, supplied by the Contractor, shall be new, and installed as indicated in the Scope of Work document. Any material removed during this project may not be reused unless permission in writing is given by the owner. The Contractor shall use only the material defined in the applicable specifications and on the accompanying Scope of Work. Any substitution of material requires prior written approval of the Owner. All materials and Equipment shall be securely anchored, plumb, level and true-in-line, maintaining alignment with adjacent work. Where installation methods are not specifically covered by the Scope of Work and/or specifications, first class trade practices and manufacturer's instructions and recommendations shall govern. The Contractor shall guarantee all equipment, materials and workmanship supplied by his/her firm and will replace all parts, and perform all necessary work, to bring the installation back into compliance within one year from the date of final acceptance.

1.8 Contractor is responsible for unloading or loading all shipments related to this project

and storing the material at a site specified by the Owner.

1.9 It is the responsibility of the Contractor to become familiar with the owner's "Contractor Safety Standards and Reference Manual" and adhere to the rules therein.

1.10 Any and all site-specific contractor requirements are to be confirmed by the owner.

1.11 Site visits are encouraged:
Make site visit reservations and requests for more information to:
Andrea' Lord, Swonder Ice Arena, Assistant Facilities Manager
Phone: 812-436-5712
Email: alord@evansville.in.gov

1.12 All work shall be performed in a clean and workmanlike manner. Care shall be exercised to minimize inconvenience or disturbance to other areas of the building which are to remain in operation. Isolate work areas by means of temporary partitions and/or tarps to keep dust and dirt within the construction area.

1.13 Coordinate all activities, equipment, and utility shutdowns which may affect activities of the building. Cooperate with the Owner's representative to minimize disruptions to the building occupants. All shutdowns of existing systems shall be scheduled and approved by the Owner prior to commencing with the work.

1.14 Use of the Owner's elevators and building corridors for handling of new and removed equipment and materials shall be at the direction of the Owner and shall be coordinated with his operations.

1.15 All equipment shall be installed per the manufacturer's written instructions and recommendations.

1.16 Take precautions against damage to any existing utilities, furnishings, and construction not included within the Scope of Work. Any damage caused by the Contractor's operation shall be repaired at his expense complete and to the satisfaction of the Owner.

1.17 Provide all necessary temporary or permanent caps or plugs for piping and ductwork. Do not leave piping open ended.

1.18 Clean the job site daily and remove from the premises any dirt and debris caused by the performance of the work included in this contract.

1.19 Contractor shall be responsible for the safekeeping of his own property on the job site. Owner assumes no responsibility for protection of properties against fire, theft, and environmental conditions.

1.20 If the Contractor encounters what appears to be a hazardous or questionable material, he shall discontinue work immediately and contact the Owner's representative.

1.21 All ductwork shall be fabricated and installed to comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible", Fourth Edition - 2020.

1.22 Unless otherwise noted, construct all rectangular and round ductwork of galvanized sheet steel complying with ASTM A527, lockforming quality, with ASTM A525, G90 zinc coating, and mill phosphatized.

1.23 Cross break or cross bead rectangular duct sides 18" and larger.

1.24 Unless otherwise noted, all rectangular tees and elbows shall have dual-wall turning vanes fabricated and installed per SMACNA standards.

1.25 Unless otherwise noted, all round elbows shall be 5-piece with a minimum 1.5 centerline radius.

1.26 All rectangular manual volume dampers (MVD) shall be opposed blade type for duct heights over 12-inches with locking quadrant operators. Provide where indicated on the drawings.

1.27 All round manual volume dampers and rectangular manual volume dampers 12-inches and under in height shall be single blade butterfly type with manual locking quadrant operators. Provide where indicated on the drawings.

1.28 All ductwork on constant volume systems shall be low pressure ductwork.

1.29 Supply ductwork shall be designed to +3" W.C. pressure class; seal class B.

1.30 Return ductwork shall be designed to -3" W.C. pressure class; seal class B.

1.31 Metal-edged flexible connectors shall be made of flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1. Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Select metal compatible with ducts. Glass fabric double coated with neoprene.

1.32 Externally insulate all supply and return air round and rectangular ductwork with 2" thick, 1.0 pcf fiberglass duct wrap with foil-scrim-kraft (FSK) facing conforming to ASTM C553, Type I, II, III, NFPA 90A and 90B, and flame spread 25/smoke developed 50 in accordance with ASTM E84. Knauf duct wrap or equal. Install according to the manufacturer's written instructions.

1.33 Contractor shall provide and install all ductwork and equipment, including equipment curbs and curb adapters, with seismic restraints as required in accordance with the requirements set forth in the latest edition of the International Building Code with Indiana amendments and ASCE Standard ASCE 7. Seismic design category D.

1.34 Seismic restraints shall comply with “Federal Emergency Management Agency (FEMA) FEMA 414 - Installing Seismic Restraints for Ductwork and Piping - December 2004; FEMA 412 - Installing Seismic Restraints for Mechanical Equipment - December 2002 SMACNA - Seismic Restraint Manual: Guidelines for Mechanical Systems - Third Edition, 2008”.

1.35 Condensate drain piping shall be PVC, Schedule 40, ASTM D 1785. Fittings shall be PVC, Schedule 40, ASTM D 2466, socket type. Solvent cement for PVC pipe, ASTM D 2564. Primer shall conform to ASTM F 656.

1.36 Natural gas piping shall be ASTM A 53/A 53M; Type E or S; Grade B; Schedule 40, black steel. Wall thickness of wrought-steel pipe shall comply with ASME B36.10M. Fittings shall be malleable-iron threaded fittings, ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1. Unions shall be ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.

1.37 Joint compound and tape shall be suitable for natural gas. Furnish pipe and fittings with factory-applied, corrosion-resistant polyethylene coating for use in contact with materials that may corrode the pipe.

1.38 Gas valves shall be two-piece forged brass low pressure full port gas valve, 600 WOG, with blow out proof brass stem, chrome plated brass ball, FNPT connections, Teflon stem packing, and Teflon seats. MSS-SP-110, ANSI Z21.15 (½ psig), and ASME B16.44 (5 psig).

1.39 Upon completion of a section or of the entire natural gas piping system, it shall be tested in strict accordance to the Fuel Gas Code requirements and the Authority Having Jurisdiction.

1.40 All air systems shall be tested, adjusted, and balanced to within plus or minus 10% of the design values by an independent, licensed, test and balance agency conforming to the National Environmental Balancing Bureau (NEBB).

1.41 Contractor shall coordinate project area exhaust requirements and barrier protection during construction with the Owner in order to maintain the project area under negative pressure with respect to the surrounding area. This shall include, but may not be limited to, sealing off the project area, providing exhaust fans as required, and temporarily sealing off or filtering existing ductwork in the area. In general, requirements shall conform to SMACNAs "IAQ Guidelines for Occupied Buildings Under Construction", Second Edition, 2007.

1.42 Contractor shall recover all refrigerant from the existing units being removed, filter it, and place in storage tanks to be turned over to the Owner.

1.43 Contractor shall provide crane and all required permitting for demolition and installation.

1.44 Contractor shall provide factory startup services for eight (8) new units.

1.45 Contractor shall provide eight (8) hours of owner training on new equipment.

1.46 Contractor shall provide five (5) years of Licensing and Software updates for the Building Automation System (BAS).

2.0 Scope of Work

Demolition Items:

1.1 Contractor shall remove complete eight (8) existing rooftop units currently serving the building in their entirety. Approximate weights for the existing units to be removed are as follows: RTU-1 (7,000 lbs), RTU-4 (7,000 lbs), RTU-5 (14,000 lbs), RTU-6 (7,000 lbs), RTU-7 (2,500 lbs), RTU-8 (2,500 lbs), RTU-9 (2,500 lbs), and RTU-10 (3,500 lbs).

1.2 The existing roof curbs for RTU-1, RTU-4, RTU-7, RTU-8, RTU-9, and RTU-10 shall remain and be reconditioned as required to allow for installation of new curb adapters for the replacement units.

1.3 Contractor shall remove associated roof curbs and sections of existing supply and return air ductwork for RTU-5 and RTU-6 as required to allow for installation of new units and curbs in similar locations. All roofing work shall be by a roofing contractor certified to work on existing roofing manufacturer to maintain warranty.

1.4 Contractor shall remove a portion of the existing natural gas branch piping serving units including existing natural gas pressure regulators to allow for routing to new units. A new pressure regulator shall be provided and installed for each of the eight (8) new units.

1.5 Contractor shall disconnect existing 460v/3ph power feed to each unit to allow for unit removal. Contractor shall adhere to OSHA Lockout/tag out procedures.

Installation Items:

1.6 Contractor shall provide and install eight (8) new rooftop units, RTU-1, RTU-4, RTU-5, RTU-6, RTU-7, RTU-8, RTU-9, and RTU-10, in similar locations to the existing units to be removed. See Section 3.0 of this Scope of Work document for Basis of Design for the new units.

1.7 Contractor shall provide and install new seismic curb adapter on existing roof curb for units RTU-1, RTU-4, RTU-7, RTU-8, RTU-9, and RTU-10. Adapters shall be attached to existing curbs per seismic specifications listed in this document.

1.8 Contractor shall provide and install new 18-inch high seismic roof curbs for new rooftop units RTU-5 and RTU-6. All roofing work shall be coordinated with the Owner so as to not void any existing roofing warranties.

1.9 Contractor shall route new sections of supply and return air ductwork from the existing mains for RTU-5 and RTU-6 as required to connect to the new units. See Scope of Work document for ductwork and insulation specifications. Contractor shall be responsible for any new roof opening(s) that may be required for connection of ductwork to these two (2) new rooftop units including required framing.

1.10 Contractor shall provide and install one (1) new natural gas pressure regulator for each unit and route branch piping to new unit natural gas connection. Natural gas branch piping and pressure regulator shall be sized to match unit requirements.

1.11 Contractor shall provide and install condensate drain trap on new rooftop unit drain connection. Condensate drain shall be routed to nearest roof drain. Typical eight (8) units.

1.12 Approximate weights of the eight (8) new rooftop units are listed in Section 3.0 of this Scope of Work document. Contractor shall be responsible for any and all required support steel modifications and/or additions for installation of the new units.

1.13 Contractor shall be responsible for all required roof deck repair, support steel modifications and/or additions for installation of new units.

1.14 Contractor shall re-connect existing electrical power to the new units with properly sized conduit, wire, and circuit breaker to meet NEC and manufacturer installation requirements. The maximum overcurrent protection for six (6) of the eight (8) new units did increase.

1.15 Reference specifications section 230900 “HVAC Instrumentation and Controls” included in this bid package for full Temperature Controls system requirements and expectations.

1.16 All bidding contractors shall meet with the owner and discuss desired Temperature Controls upgrades prior to submitting their bid. Below is a listing of minimum required building controls system upgrades.

1.17 The building currently utilizes a Tridium based front end temperature controls system (BAS). The current system shall be upgraded to the latest revision of Tridium software.

1.18 All new rooftop units shall be provided with factory package controls that are to be integrated into the BAS front end.

1.19 The eight (8) existing rooftop units to be replaced currently utilize a Johnson Controls N2 Bus. The intent is to replace this existing wiring and switch to BACnet.

1.20 The existing unit serving the Office area (RTU-7) is a VVT system utilizing JCI FX branded BACnet controllers that determine the leaving air temperature setpoint for the unit. These existing controllers are to be reused and reworked to write this setpoint to the new RTU-7.

1.21 All zone sensors associated with the new rooftop units shall be replaced.

1.22 Integral unit controllers shall be responsible for economizer and humidity control.

3.0 Rooftop Unit Basis of Design

3.1 The Basis of Design for the eight (8) new rooftop units are AAON, RNA Series, with DX cooling, natural gas heating, energy recovery wheel, and modulating hot gas reheat for humidity control.

3.2 Vendor Selections (AC Equipment Reps, Inc.); 502-396-7777 or 317-921-8825:

RTU-1 (RNA-026)

AAON

Unit Rating

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

RNA-026-D-A-3-GAB0C-CB2L0:00-AAFAJ-KDK-00000-BGNBJ-DC-0M0
J-00-E0-C-AR0-EB-EA0A-00-000-B00A00-C00BAF-0000A0B

Tag: RTU #1

Job Information

Job Name:	*Swonder Phase 3 - 2025*
Job Number:	*AC2533687*
Site Altitude:	*386 ft*
Refrigerant:	*R-454B*
Design System Charge (oz):	*396 / 607*

Static Pressure

External:	*2.00 in. w.g.*
Cooling Coil:	*0.38 in. w.g.*
Filters Clean:	*0.19 in. w.g.*
Dirt Allowance:	*0.35 in. w.g.*
Reheat Coil:	*0.07 in. w.g.*

Cooling Section

	Gross	Net
Equivalent Total Capacity:	*418.4 MBH*	*387.1 MBH*
Total Capacity:	*317.2 MBH*	*285.9 MBH*
Sensible Capacity:	*292.5 MBH*	*261.2 MBH*
Latent Capacity:	*24.7 MBH*	
HW Total Cooling Capacity:	*101.2 MBH*	
Mixed Air Temp (DB/WB):	*76.1 °F / 62.7 °F*	
Entering Air Temp (DB/WB):	*76.1 °F / 62.7 °F*	
Lv Air Temp (Coil) (DB/WB):	*54.1 °F / 53.8 °F*	
Lv Air Temp (Unit) (DB/WB):	*56.4 °F / 54.7 °F*	

Supply Air Fan:	*2 x 245D @ 5.60 BHP Ea.*
SA Fan RPM / Width:	*1455 RPM / 5.560 in*
SA Fan FEI:	*1.04*
Exhaust Air Fan:	*2 x RM270B70-RN @ 3.03 BHP Ea.*
EA Fan RPM / Width:	*1196 RPM / 4.290 in*
EA Fan FEI:	*1.03*
Evaporator Coil:	*32.1 ft² / 6 Rows / 12 FPI*
Evaporator Face Velocity:	*388.9 fpm*
Energy Recovery:	*2 x ERC-5255C-4M*

Unit Information

Approx. Op./Ship Weights:	*7059 lbs / 7059 lbs (±5%)*
Ambient Temperature (DB/WB):	*95.0 °F / 75.0 °F*
Coil Filter FV / Qty:	*390.6 fpm / 8*
Min. Room Area/Height/Airflow**:	*569 ft² / 7 ft / 1027 SCFM*
Exhaust Airflow/ESP/TSP:	*12500 SCFM / 1.00 in. w.g. / 1.72 in. w.g.*
Outside Air Prefilter FV / Qty:	*203.4 fpm / 6*
Supply Airflow/ESP:	*12500 SCFM / 2.00 in. w.g.*
Outside Airflow:	*3000 SCFM*
Return Temperature (DB/WB):	*75.0 °F / 62.0 °F*
Economizer:	*0.21 in. w.g.*
Heating:	*0.07 in. w.g.*
Cabinet:	*0.07 in. w.g.*
Energy Recovery:	*0.26 in. w.g.*
Total:	*3.35 in. w.g.*

Heating Section

Preheat Type:	*Std (No Preheat)*
Auxiliary Heating Type:	*Nat. Gas Heat*
Heating Airflow:	*12500 SCFM*
Total Capacity:	*486.0 MBH*
Entering Air Temp (DB/WB):	*70.4 °F / 59.7 °F*
Leaving Air Temp (DB/WB):	*106.3 °F / 71.3 °F*
Consumption:	*600.0 MBH*
Total Turndown Ratio:	*10.0:1*

Re-heat Coil:

Capacity:	*189.4 MBH*
Leaving Air Temp (DB/WB):	*68.4 °F / 59.3 °F*
Relative Humidity:	*59.1%*

Rating Information

Listing Model	*RN-026-3-0-GABY-V0-21-000-A*
Cooling Capacity:	*302.0 MBH*
Cooling EER:	*11.56 BTU/h-W*
Cooling IEER:	*14.41 BTU/h-W*

**Rated in accordance with AHRI Standard 340/360 (I-P)*

Application EER @ Op. Conditions: ***10.4 BTU/h-W***

Electrical Data

Unit Rating

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

Circuit 1

Rating:	*460V/3Ø/60Hz*	*Minimum Circuit Amp:*	*97*
Unit FLA:	*92*	*Maximum Overcurrent:*	*110*
SCCR:	*10 KAIC*		

	Qty	*HP*	*VAC*	*Phase*	*RPM*	*FLA*	*RLA*
Compressor 1:	*1*		*460*	*3*	*3500*		*19.9*
Compressor 2:	*1*		*460*	*3*	*3500*		*19.7*
Condenser Fan:	*4*	*1.00*	*460*	*1*	*1100*	*3.6*	
Supply Fan:	*2*	*7.50*	*460*	*3*	*1760*	*11.0*	
Exhaust Fan:	*2*	*5.00*	*460*	*3*	*1760*	*7.6*	
Combustion:	*2*	*0.25*	*460*	*1*	*3200*	*0.9*	
Energy Recovery:	*2*	*0.17*	*460*	*1*	*1075*	*0.6*	

Cabinet Sound Power Levels*

Octave Bands:	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Discharge LW (dB):	*93*	*93*	*95*	*100*	*98*	*96*	*90*	*84*
Return LW (dB):	*91*	*89*	*87*	*85*	*86*	*87*	*85*	*81*

**Sound data is generated by a proprietary acoustics model validated through unit testing in accordance with AHRI 260, utilizing tested fan sound data in accordance with AMCA 300.*

*****The minimum floor area for the Lower Flammability Limit (LFL) is calculated in accordance with UL60335-2-40 4th ed. (operating or storage). For UL60335-2-40 3rd ed. double the airflow and minimum floor area listed.***

Unit Rating

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 356

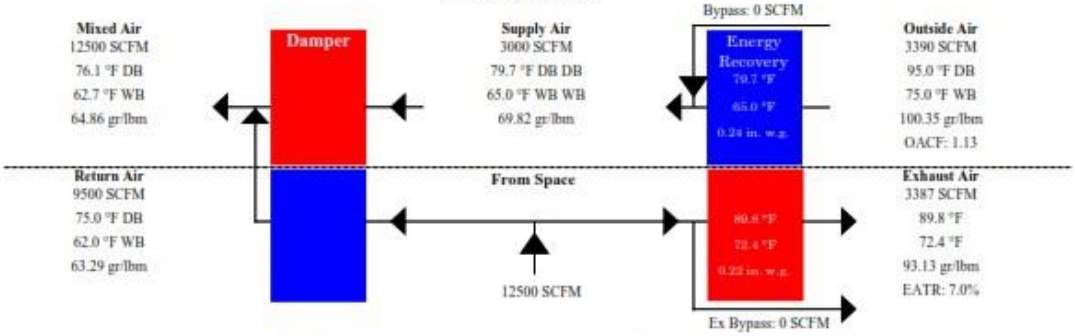
```
RNA-026-D-A-3-GAB0C-CB2L0:00-AAFAJ-KDK-00000-BGNBJ-DC-0M0
J-00-E0-C-AR0-EB-EA0A-00-000-B00A00-C00BAF-0000A0B
```

Tag: RTU #1

Job Name:	**Swonder Phase 3 - 2025**	Energy Recovery Type:	**Total**
Job Number:	**AC2533687**	Energy Recovery Model:	**ERC-5255C-4M**
Site Altitude:	**386 ft**	Energy Recovery Qty:	**2**
Net Supply Airflow Sum/Win:	**2790 SCFM / 2790 SCFM**	Energy Recovery Software Ver:	**1.1.0.0**
Purge Angle:	**10.0°**		

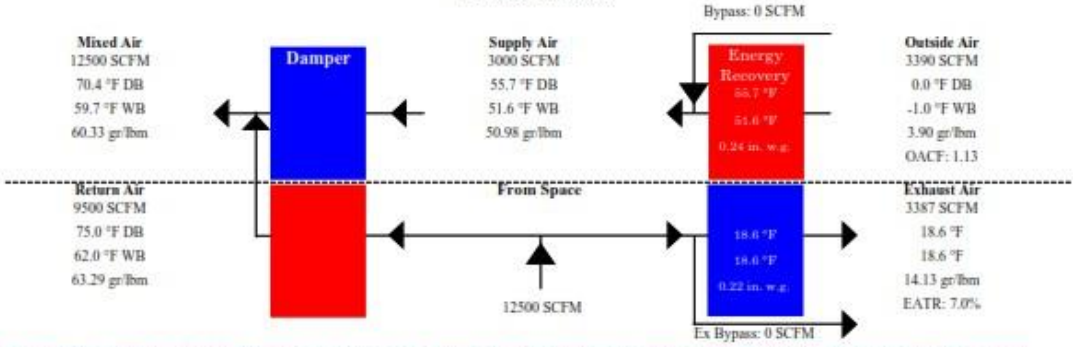
Application Rating is outside the scope of the AHRI ERV Certification Program but is rated in accordance with AHRI Standard 1060.

Summer Conditions



	Cooling/Dehumidification	Heating/Dehumidification	Effectiveness
Total Capacity:	101.2 MBH	0.0 MBH	78.1%
Sensible Capacity:	43.2 MBH	0.0 MBH	74.7%
Latent Capacity:	58.0 MBH	0.0 MBH	81.1%

Winter Conditions



Frost Warning - Conditions for frost forming on the energy recovery exists. Outside air preheat is required to prevent frost formation. Optionally, the return air humidity ratio could be lowered to prevent frost formation. See AAON literature titled 'AAONAIRE ENERGY RECOVERY' for details.

	Cooling/Dehumidification	Heating/Dehumidification	Effectiveness
Total Capacity:	0.0 MBH	256.9 MBH	76.8%
Sensible Capacity:	0.0 MBH	165.5 MBH	75.5%
Latent Capacity:	0.0 MBH	91.4 MBH	81.1%

24.5" STAR Plenum

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

JOB INFORMATION:

Job Name:	*Swonder Phase 3 - 2025*
Job Tag:	*RTU #1*
Date:	*6/4/2025 12:00:00 AM*

WHEEL SPECIFICATION:

Max RPM:	*2000*
Diameter x Qty:	*24.5 in. x 2*
CFM:	*6250*
Inertia:	*10WR²*

OPERATING CONDITIONS

Air Flow:	*6250*
Fan Energy Index (FEI):	*1.04*
Static Pressure:	*3.35 in. Wg*
Relief Dampers DP:	*0 in. Wg*
TSP:	*3.40 in. Wg*
Site Altitude	*386 ft*
TSP @ Sea Level:	*3.40 in. Wg*

MOTOR SELECTION

Rated HP / Bypass:	*7.5 x 2 / No*
Frame Size:	*213T*
Nominal RPM:	*1760*
VAC/PH/HZ:	*460V/3Ø/60Hz*
Enclosure Type:	*ODP*
Max Inertial Load:	*0 WR²*

FAN PERFORMANCE:

RPM:	*1455*
BHP:	*5.60*
Efficiency:	*58.94%*
Max Duct SP with Blocked Airway:	*0 in. Wg @1455 RPM*

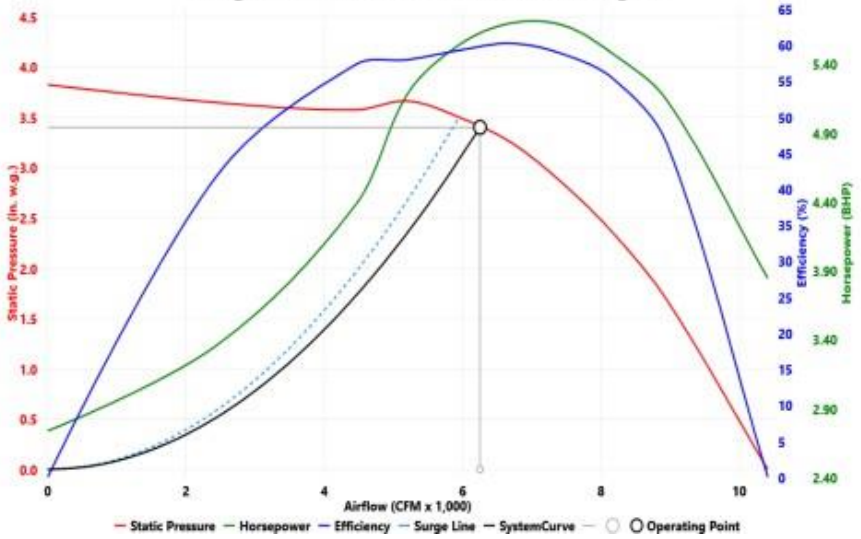
Max Duct SP with Blocked Airway:

FAN SOUND POWER (Inlet/Outlet)

Octave Band:							(Re 10^-12 watts)
1	2	3	4	5	6	7	8
93	92	91	92	89	87	85	81
93	92	94	100	99	97	92	86

SOUND POWER A-Weighted: 102 dB

Supply Fan Model: 245D x 2 @ 1455 RPM and 100% Width
Design Conditions: 6250 CFM @ 3.40 in. w.g. SP



27.4" STAR Plenum

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

JOB INFORMATION:

Job Name:	*Swonder Phase 3 - 2025*
Job Tag:	*RTU #1*
Date:	*6/4/2025 12:00:00 AM*

WHEEL SPECIFICATION:

Max RPM:	*1800*
Diameter x Qty:	*27.4 in. x 2*
CFM:	*6250*
Inertia:	*14WR²*

OPERATING CONDITIONS

Air Flow:	*6250*
Fan Energy Index (FEI):	*1.03*
Static Pressure:	*1.72 in. Wg*
Relief Dampers DP:	*0 in. Wg*
TSP:	*1.74 in. Wg*
Site Altitude	*386 ft*
TSP @ Sea Level:	*1.74 in. Wg*

MOTOR SELECTION

Rated HP / Bypass:	*5 x 2 / No*
Frame Size:	*184T*
Nominal RPM:	*1760*
VAC/PH/HZ:	*460V/3Ø/60Hz*
Enclosure Type:	*ODP*
Max Inertial Load:	*0 WR²*

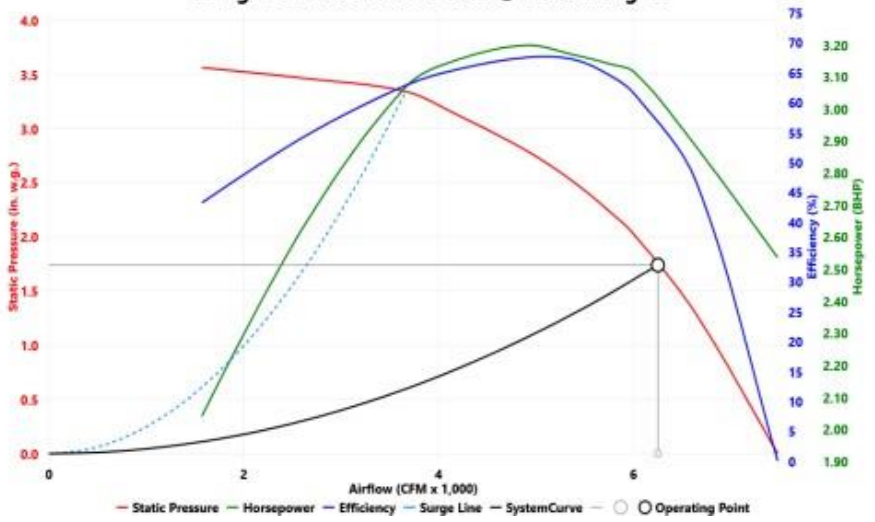
FAN PERFORMANCE

RPM:	*1196*
BHP:	*3.03*
Efficiency:	*55.93%*
Max Duct SP with Blocked Airway:	*0 in. Wg @1196 RPM*
Max Duct SP with Blocked Airway:	

FAN SOUND POWER (Inlet/Outlet)

Octave Band:								(Re 10^-12 watts)
1	2	3	4	5	6	7	8	
1	2	3	4	5	6	7	8	
87	86	84	83	83	84	84	83	SOUND POWER A-Weighted: dB

Exhaust Fan Model: RM270B70 x 2 @ 1196 RPM and 100% Width
Design Conditions: 6250 CFM @ 1.74 in. w.g. SP



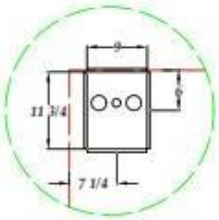
RN UNITS 26-31 TON
AIR COOLED, ENERGY RECOVERY WHEEL, POWER EXHAUST, RETURN AIR FILTER, RNA-D

AAON

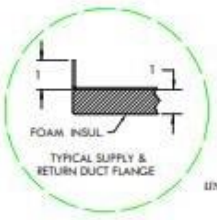
CLEARANCES

LOCATION	UNIT SIZE 26-31 TON
RETURN AIR BACK	48
VENT SIDE FRONT	48
LEFT SIDE	48
RIGHT SIDE	70
TOP	UNOBSTRUCTED

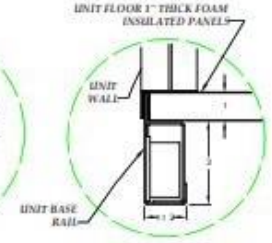
NOTE: RIGHT AND LEFT SIDE UNIT CLEARANCES ARE INTERCHANGEABLE ON UNITS THAT DO NOT HAVE THE HYDRONIC HEATING OPTION. (UNITS WITH HYDRONIC HEAT MUST HAVE 70" RIGHT SIDE ACCESS FOR SERVICE.)



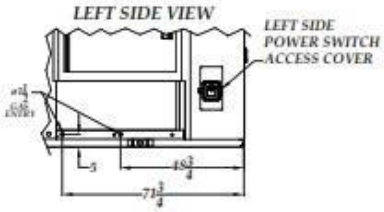
DETAIL A
UTILITY ENTRY

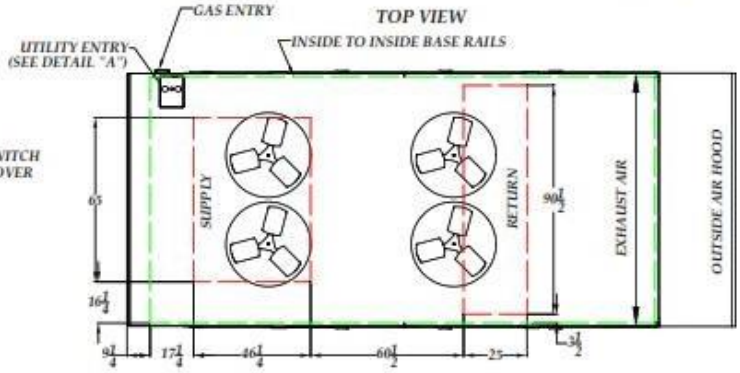


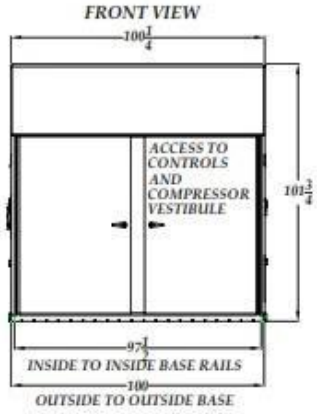
TYPICAL SUPPLY & RETURN DUCT FLANGE
DETAIL B

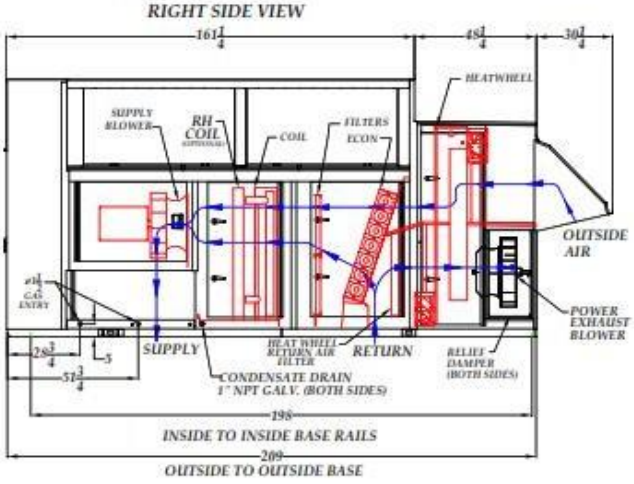


BASE RAIL CLEARANCE









CAT000549 RNA-D REV:A 06/26/24 JWC
ALL DIMENSIONS ARE IN INCHES

FIELD GAS PIPING DETAILS

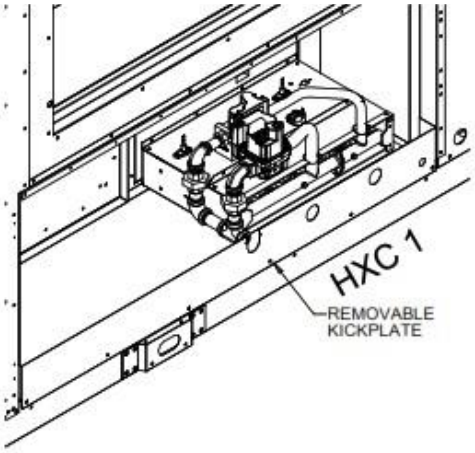
RNA SERIES D - CABINET
26-70 TON

600 MBH
4 STAGE, HIGH TURNDOWN

CAT000432A RNA-D REV A 04/25/23 JAS
ALL DIMENSIONS ARE IN INCHES

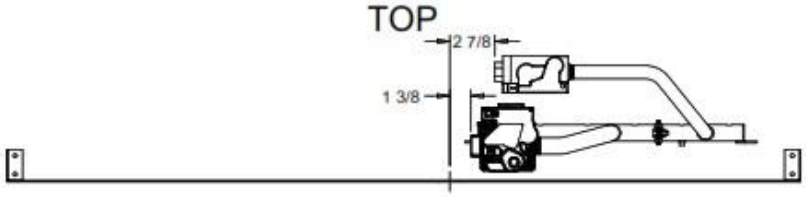
Field gas piping is required to the internal gas valves.
Piping should be installed adhering to building codes.
Perform leak check prior to operation.

Reference IOM for additonal information,
and details on optional gas entry through base.

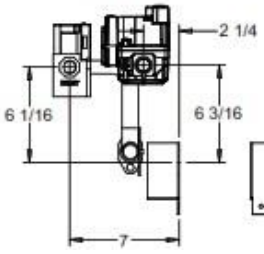


RIGHT SIDE VIEW

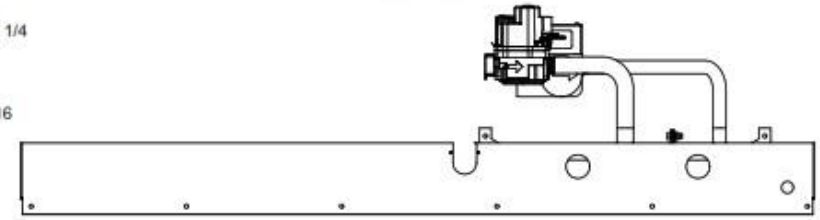
HEAT
EXCHANGER 1



SIDE



FRONT



FIELD GAS PIPING DETAILS

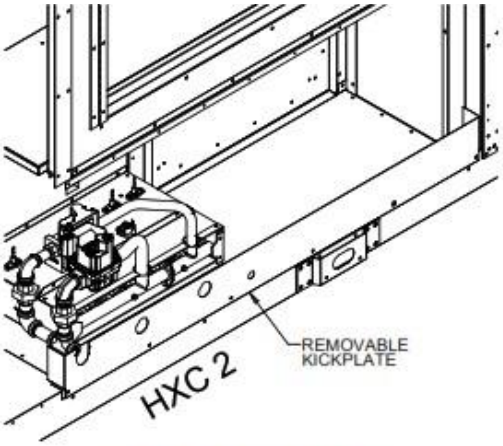
RNA SERIES D - CABINET
26-70 TON

600 MBH
4 STAGE, HIGH TURNDOWN

CAT000432B RNA-D REV A 04/25/23 JAS
ALL DIMENSIONS ARE IN INCHES

Field gas piping is required to the internal gas valves.
Piping should be installed adhering to building codes.
Perform leak check prior to operation.

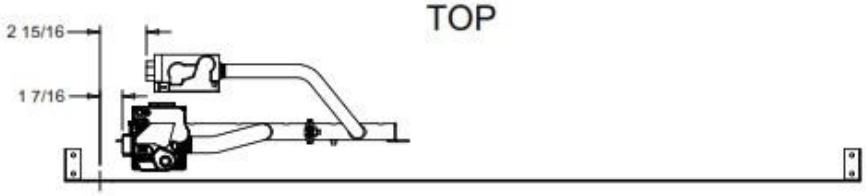
Reference IOM for additonal information,
and details on optional gas entry through base.



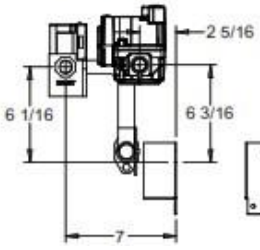
LEFT SIDE VIEW

HEAT
EXCHANGER 2

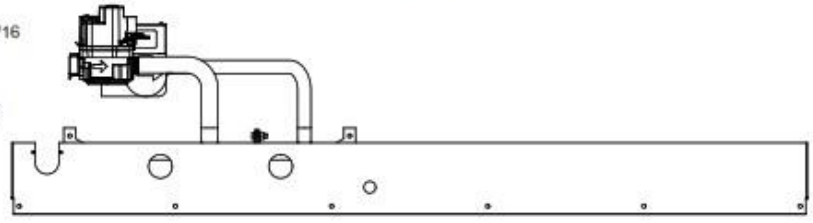
TOP



SIDE



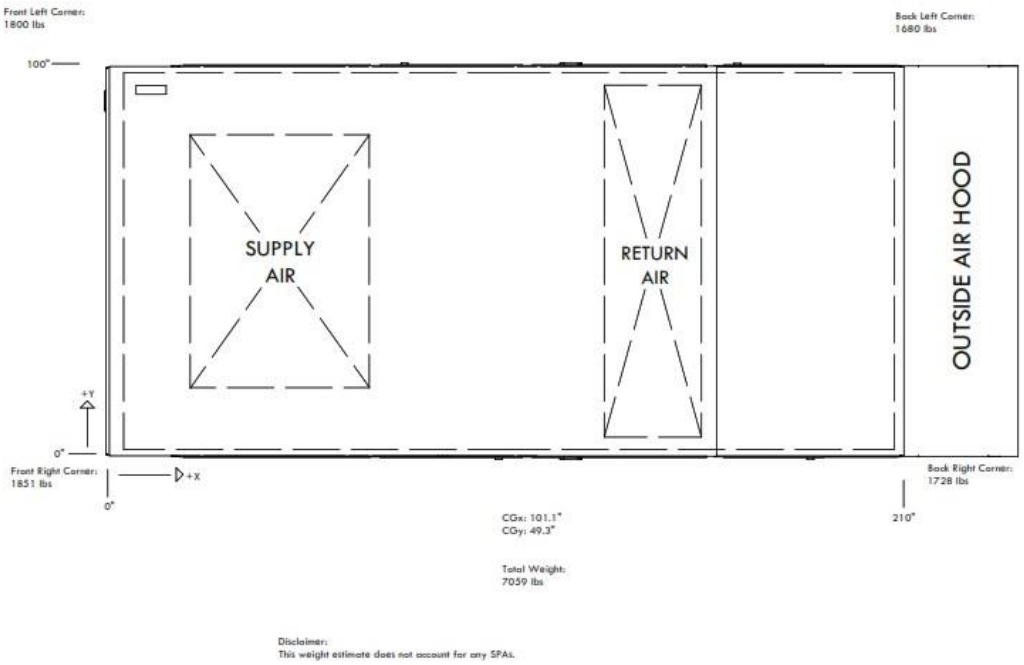
FRONT



RND CABINET
AIR COOLED CONDENSING UNIT
ENERGY RECOVERY SECTION

AAON

RNA-026-D-A-3-GAB0C-CB2L0:00-AAFAJ-KDK-00000-BGNBJ-DC-0M0J-00-E0-C-AR0-EB-EA0A-00-000-B00A00-C00BAF-0000A0B



Disclaimer:
This weight estimate does not account for any SPAs.

RTU-4 (RNA-031)

Unit Rating

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 356

RNA-031-D-A-3-GAB0C-CB2L0:00-AAFAK-KDK-00000-BGNBJ-DC-0M0J-00-E0-C-AR0-EB-EA0A-00-000-B00A00-C00BAF-0000A0B

Tag: RTU #4

Job Information

Job Name:	*Swonder Phase 3 - 2025*
Job Number:	*AC2533687*
Site Altitude:	*386 ft*
Refrigerant:	*R-454B*
Design System Charge (oz):	*466 / 678*

Unit Information

Approx. Op./Ship Weights:	*7088 lbs / 7088 lbs (±5%)*
Ambient Temperature (DB/WB):	*95.0 °F / 75.0 °F*
Coil Filter FV / Qty:	*406.3 fpm / 8*
Min. Room Area/Height/Airflow**:	*636 ft² / 7 ft / 1147 SCFM*
Exhaust Airflow/ESP/TSP:	*13000 SCFM / 0.50 in. w.g. / 1.23 in. w.g.*
Outside Air Prefilter FV / Qty:	*193.4 fpm / 6*
Supply Airflow/ESP:	*13000 SCFM / 2.50 in. w.g.*
Outside Airflow:	*3000 SCFM*
Return Temperature (DB/WB):	*75.0 °F / 62.0 °F*

Static Pressure

External:	*2.50 in. w.g.*	Economizer:	*0.22 in. w.g.*
Cooling Coil:	*0.43 in. w.g.*	Heating:	*0.07 in. w.g.*
Filters Clean:	*0.21 in. w.g.*	Cabinet:	*0.08 in. w.g.*
Dirt Allowance:	*0.35 in. w.g.*	Energy Recovery:	*0.25 in. w.g.*
Reheat Coil:	*0.08 in. w.g.*	Total:	*3.93 in. w.g.*

Cooling Section

	Gross	Net
Equivalent Total Capacity:	*448.0 MBH*	*409.8 MBH*
Total Capacity:	*348.9 MBH*	*310.7 MBH*
Sensible Capacity:	*311.6 MBH*	*273.4 MBH*
Latent Capacity:	*37.3 MBH*	
HW Total Cooling Capacity:	*99.1 MBH*	
Mixed Air Temp (DB/WB):	*76.1 °F / 62.7 °F*	
Entering Air Temp (DB/WB):	*76.1 °F / 62.7 °F*	
Lv Air Temp (Coil) (DB/WB):	*53.5 °F / 53.2 °F*	
Lv Air Temp (Unit) (DB/WB):	*56.2 °F / 54.3 °F*	

Supply Air Fan:	*2 x 245D @ 6.88 BHP Ea.*
SA Fan RPM / Width:	*1562 RPM / 5.560 in*
SA Fan FEI:	*1.01*
Exhaust Air Fan:	*2 x RM270B70-RN @ 2.72 BHP Ea.*
EA Fan RPM / Width:	*1172 RPM / 4.290 in*
EA Fan FEI:	*0.92*
Evaporator Coil:	*32.1 ft² / 6 Rows / 12 FPI*
Evaporator Face Velocity:	*404.5 fpm*
Energy Recovery:	*2 x ERC-5255C-4M*

Heating Section

Preheat Type:	*Std (No Preheat)*
Auxiliary Heating Type:	*Nat. Gas Heat*
Heating Airflow:	*13000 SCFM*
Total Capacity:	*486.0 MBH*
Entering Air Temp (DB/WB):	*70.6 °F / 59.8 °F*
Leaving Air Temp (DB/WB):	*105.2 °F / 71.0 °F*
Consumption:	*600.0 MBH*
Total Turndown Ratio:	*10.0:1*

Re-heat Coil:

Capacity:	*211.6 MBH*
Leaving Air Temp (DB/WB):	*68.8 °F / 59.2 °F*
Relative Humidity:	*56.8%*

Rating Information

Listing Model	*RN-031-3-0-GABY-V0-21-000-A*
Cooling Capacity:	*356.0 MBH*
Cooling EER:	*10.68 BTU/h·W*
Cooling IEER:	*13.62 BTU/h·W*

**Rated in accordance with AHRI Standard 340/360 (I-P)*

Application EER @ Op. Conditions: ***9.9 BTU/h·W***

Unit Rating

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

Circuit 1

Rating:	460V/3Ø/60Hz	Minimum Circuit Amp:	105
Unit FLA:	100	Maximum Overcurrent:	125
SCCR:	10 KAIC		

	Qty	HP	VAC	Phase	RPM	FLA	RLA
Compressor 1:	1		460	3	3500		19.9
Compressor 2:	1		460	3	3500		21.2
Condenser Fan:	4	1.00	460	1	1100	3.6	
Supply Fan:	2	10.00	460	3	1760	14.0	
Exhaust Fan:	2	5.00	460	3	1760	7.6	
Combustion:	2	0.25	460	1	3200	0.9	
Energy Recovery:	2	0.17	460	1	1075	0.6	

Cabinet Sound Power Levels*

Octave Bands:	63	125	250	500	1000	2000	4000	8000
Discharge LW (dB):	96	94	95	101	99	98	92	86
Return LW (dB):	91	89	87	85	86	87	85	81

*Sound data is generated by a proprietary acoustics model validated through unit testing in accordance with AHRI 260, utilizing tested fan sound data in accordance with AMCA 300.

**The minimum floor area for the Lower Flammability Limit (LFL) is calculated in accordance with UL60335-2-40 4th ed. (operating or storage). For UL60335-2-40 3rd ed. double the airflow and minimum floor area listed.

Unit Rating

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

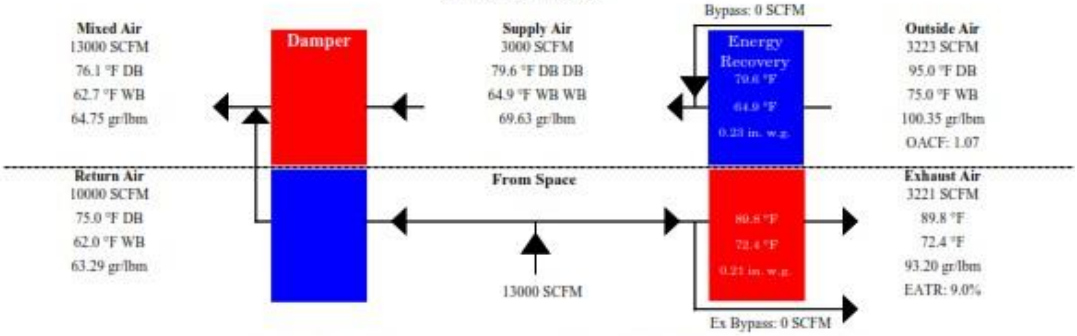
RNA-031-D-A-3-GAB0C-CB2L0:00-AAFAK-KDK-00000-BGNBJ-DC-0M0
J-00-E0-C-AR0-EB-EA0A-00-000-B00A00-C00BAF-0000A0B

Tag: RTU #4

Job Name:	**Swonder Phase 3 - 2025**	Energy Recovery Type:	**Total**
Job Number:	**AC2533687**	Energy Recovery Model:	**ERC-5255C-4M**
Site Altitude:	**386 ft**	Energy Recovery Qty:	**2**
Net Supply Airflow Sum/Win:	**2729 SCFM / 2729 SCFM**	Energy Recovery Software Ver:	**1.1.0.0**
Purge Angle:	**10.0°**		

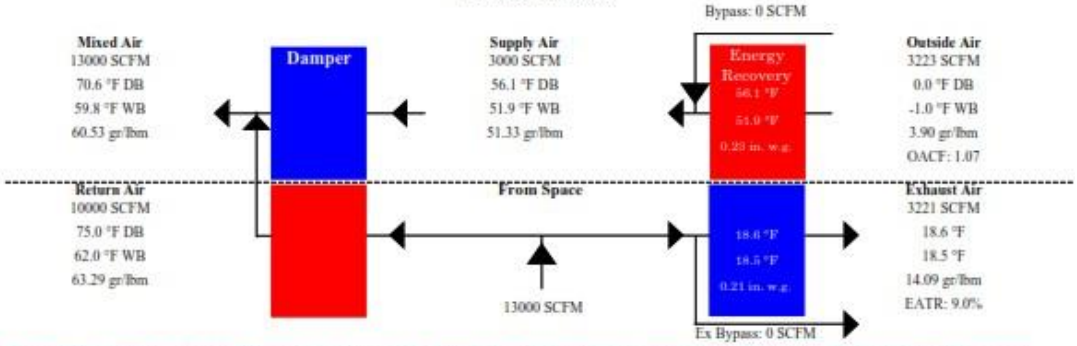
Application Rating is outside the scope of the AHRI ERV Certification Program but is rated in accordance with AHRI Standard 1060.

Summer Conditions



	Cooling/Dehumidification	Heating/Dehumidification	Effectiveness
Total Capacity:	99.1 MBH	0.0 MBH	78.2%
Sensible Capacity:	42.3 MBH	0.0 MBH	74.7%
Latent Capacity:	56.8 MBH	0.0 MBH	81.3%

Winter Conditions



Frost Warning - Conditions for frost forming on the energy recovery exists. Outside air preheat is required to prevent frost formation. Optionally, the return air humidity ratio could be lowered to prevent frost formation. See AAON literature titled 'AAONAIRE ENERGY RECOVERY' for details.

	Cooling/Dehumidification	Heating/Dehumidification	Effectiveness
Total Capacity:	0.0 MBH	251.5 MBH	76.7%
Sensible Capacity:	0.0 MBH	161.9 MBH	75.5%
Latent Capacity:	0.0 MBH	89.6 MBH	81.3%

24.5" STAR Plenum

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

JOB INFORMATION:

Job Name:	*Swonder Phase 3 - 2025*
Job Tag:	*RTU #4*
Date:	*6/4/2025 12:00:00 AM*

WHEEL SPECIFICATION:

Max RPM:	*2000*
Diameter x Qty:	*24.5 in. x 2*
CFM:	*6500*
Inertia:	*10WR²*

OPERATING CONDITIONS

Air Flow:	*6500*
Fan Energy Index (FEI):	*1.01*
Static Pressure:	*3.93 in. Wg*
Relief Dampers DP:	*0 in. Wg*
TSP:	*3.99 in. Wg*
Site Altitude	*386 ft*
TSP @ Sea Level:	*3.99 in. Wg*

MOTOR SELECTION

Rated HP / Bypass:	*10 x 2 / No*
Frame Size:	*215T*
Nominal RPM:	*1760*
VAC/PH/HZ:	*460V/3Ø/60Hz*
Enclosure Type:	*ODP*
Max Inertial Load:	*0 WR²*

FAN PERFORMANCE:

RPM:	*1562*
BHP:	*6.88*
Efficiency:	*58.53%*
Max Duct SP with Blocked Airway:	*0 in. Wg @1562 RPM*

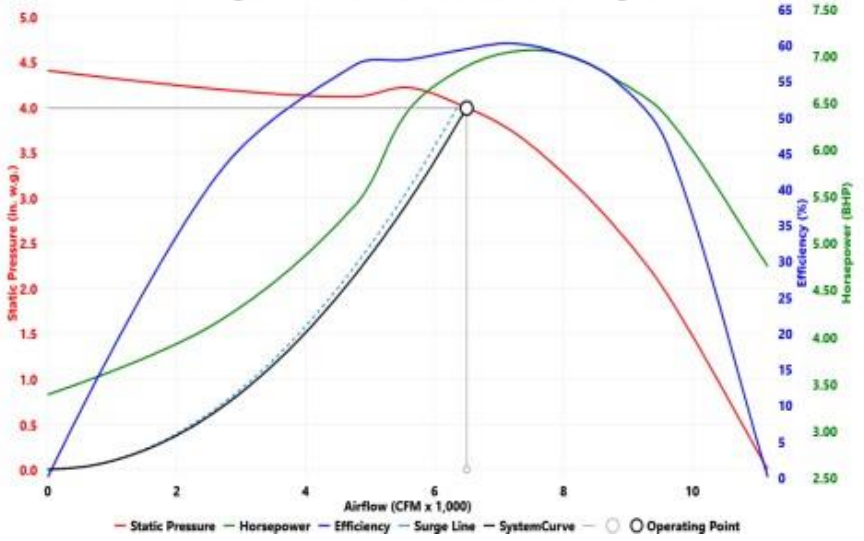
Max Duct SP with Blocked Airway:

FAN SOUND POWER (Inlet/Outlet)

Octave Band:	1	2	3	4	5	6	7	8
(Re 10^-12 watts)	95	94	93	93	90	89	87	83
	95	93	94	101	100	99	94	88

SOUND POWER A-Weighted: 104 dB

Supply Fan Model: 245D x 2 @ 1562 RPM and 100% Width
Design Conditions: 6500 CFM @ 3.99 in. w.g. SP



27.4" STAR Plenum

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

JOB INFORMATION:

Job Name:	*Swonder Phase 3 - 2025*
Job Tag:	*RTU #4*
Date:	*6/4/2025 12:00:00 AM*

WHEEL SPECIFICATION:

Max RPM:	*1800*
Diameter x Qty:	*27.4 in. x 2*
CFM:	*6500*
Inertia:	*14WR²*

OPERATING CONDITIONS

Air Flow:	*6500*
Fan Energy Index (FEI):	*0.92*
Static Pressure:	*1.23 in. Wg*
Relief Dampers DP:	*0 in. Wg*
TSP:	*1.25 in. Wg*
Site Altitude	*386 ft*
TSP @ Sea Level:	*1.25 in. Wg*

MOTOR SELECTION

Rated HP / Bypass:	*5 x 2 / No*
Frame Size:	*184T*
Nominal RPM:	*1760*
VAC/PH/HZ:	*460V/3Ø/60Hz*
Enclosure Type:	*ODP*
Max Inertial Load:	*0 WR²*

FAN PERFORMANCE

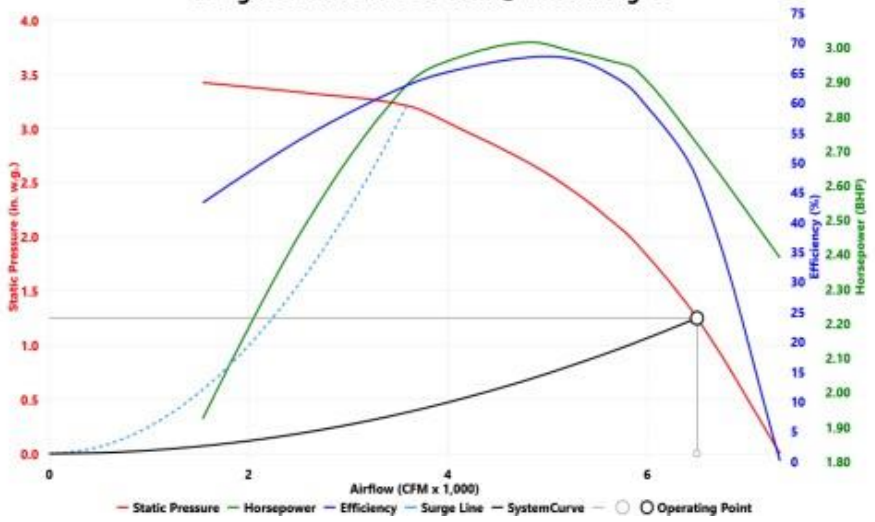
RPM:	*1172*
BHP:	*2.72*
Efficiency:	*46.34%*
Max Duct SP with Blocked Airway:	*0 in. Wg @1172 RPM*
Max Duct SP with Blocked Airway:	

FAN SOUND POWER (Inlet/Outlet)

Octave Band:							(Re 10^-12 watts)
1	2	3	4	5	6	7	8
1	2	3	4	5	6	7	8
87	86	84	82	83	84	84	83

SOUND POWER A-Weighted: dB

Exhaust Fan Model: RM270B70 x 2 @ 1172 RPM and 100% Width
Design Conditions: 6500 CFM @ 1.25 in. w.g. SP

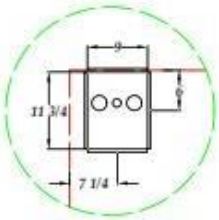


RN UNITS 26-31 TON
AIR COOLED, ENERGY RECOVERY WHEEL, POWER EXHAUST, RETURN AIR FILTER, RNA-D

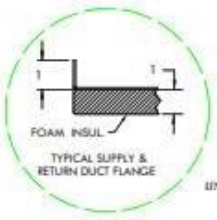
AAON

CLEARANCES	
LOCATION	UNIT SIZE 26-31 TON
RETURN AIR BACK	48
VENT SIDE FRONT	48
LEFT SIDE	48
RIGHT SIDE	70
TOP	UNOBSTRUCTED

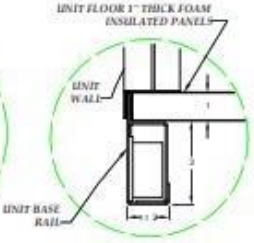
NOTE: RIGHT AND LEFT SIDE UNIT CLEARANCES ARE INTERCHANGEABLE ON UNITS THAT DO NOT HAVE THE HYDRONIC HEATING OPTION. (UNITS WITH HYDRONIC HEAT MUST HAVE 70" RIGHT SIDE ACCESS FOR SERVICE.)



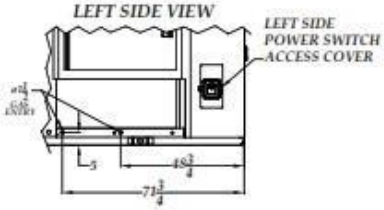
DETAIL A
UTILITY ENTRY

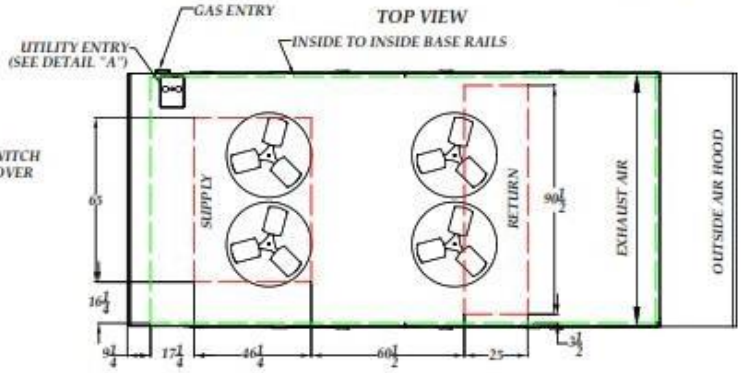


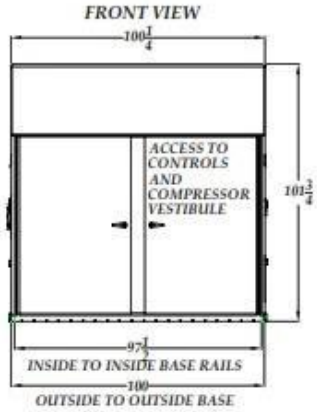
DETAIL B
TYPICAL SUPPLY & RETURN DUCT FLANGE

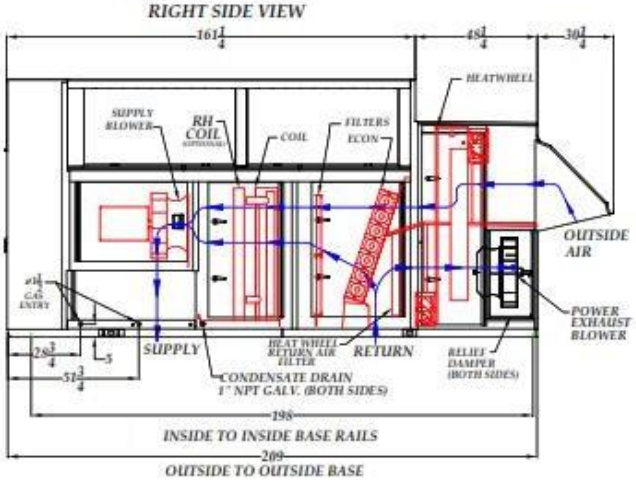


BASE RAIL CLEARANCE









CAT000549 RNA-D REV:A 06/26/24 JWC
ALL DIMENSIONS ARE IN INCHES

FIELD GAS PIPING DETAILS

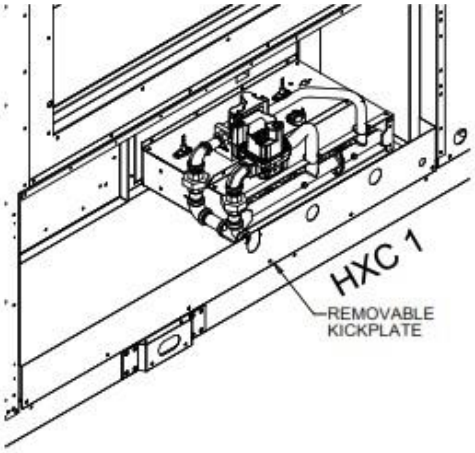
RNA SERIES D - CABINET
26-70 TON

600 MBH
4 STAGE, HIGH TURNDOWN

CAT000432A RNA-D REV A 04/25/23 JAS
ALL DIMENSIONS ARE IN INCHES

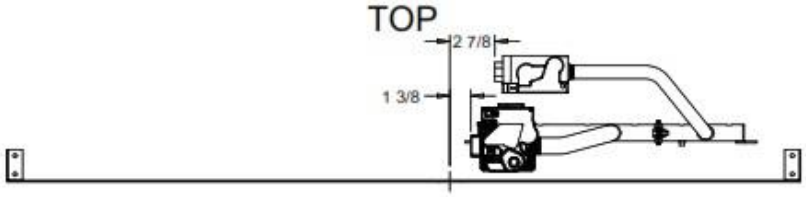
Field gas piping is required to the internal gas valves.
Piping should be installed adhering to building codes.
Perform leak check prior to operation.

Reference IOM for additonal information,
and details on optional gas entry through base.

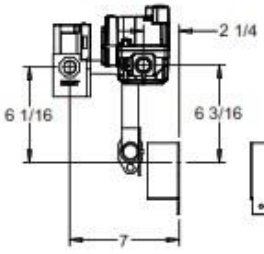


RIGHT SIDE VIEW

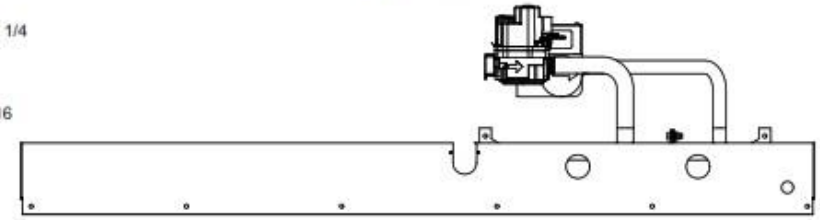
HEAT
EXCHANGER 1



SIDE



FRONT



FIELD GAS PIPING DETAILS

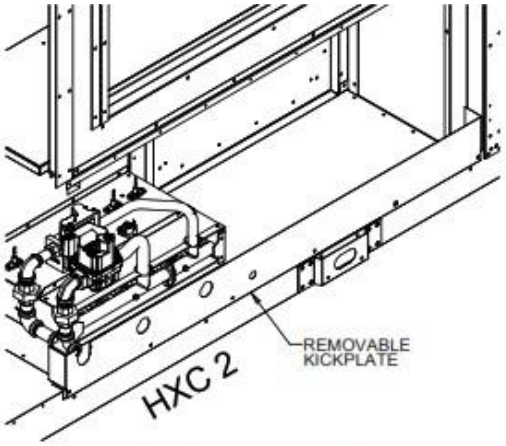
RNA SERIES D - CABINET
26-70 TON

600 MBH
4 STAGE, HIGH TURNDOWN

CAT000432B RNA-D REV A 04/25/23 JAS
ALL DIMENSIONS ARE IN INCHES

Field gas piping is required to the internal gas valves.
Piping should be installed adhering to building codes.
Perform leak check prior to operation.

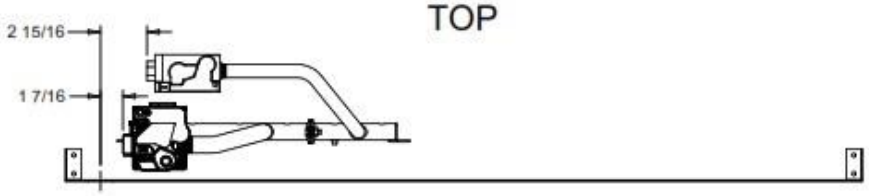
Reference IOM for additonal information,
and details on optional gas entry through base.



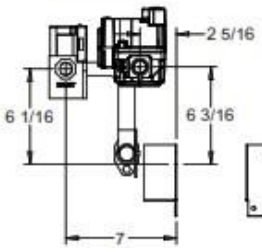
LEFT SIDE VIEW

HEAT
EXCHANGER 2

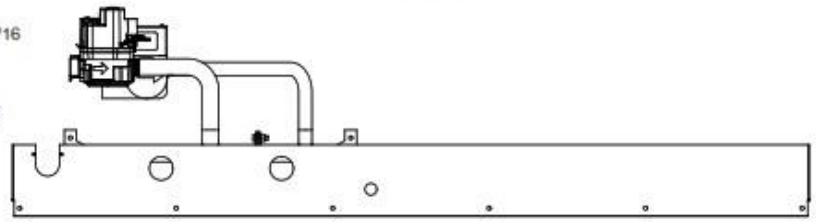
TOP



SIDE



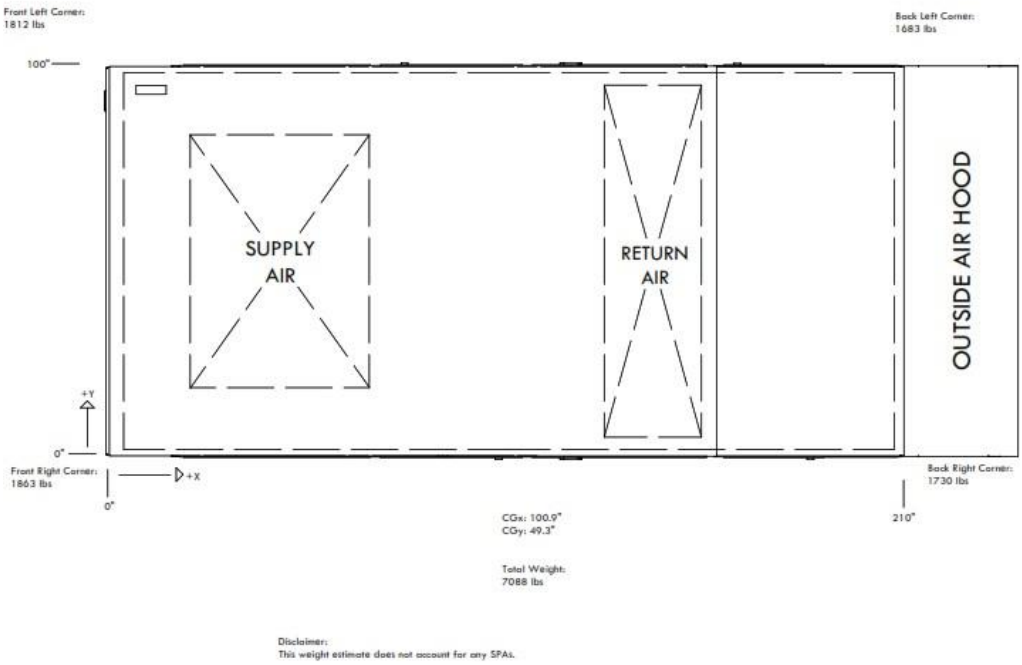
FRONT



RND CABINET
AIR COOLED CONDENSING UNIT
ENERGY RECOVERY SECTION

AAON

RNA-031-D-A-3-GAB0C-CB2L0:00-AAFAK-KDK-00000-BGNBJ-DC-0M0J-00-E0-C-AR0-EB-EA0A-00-000-B00A00-C00BAF-0000A0B



Disclaimer:
This weight estimate does not account for any SPAs.

RTU-5 (RNA-031)

AAON®

Unit Rating

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 356

A1 A2 A3 A4 A5 B1 B2 B3 B4 B5 1 2 3A 3B 3C 3D 3E 4A 4B 4C 5A 5B 5C 5D 5E 6A 6B 6C 6D 6E 7 8 9A 9B 9C
RNA-031-D-A-3-GAB0C-CB3K0:00-0AGAL-KDK-00000-ABNBL-DC-0M0
J-00-E0-C-AR0-EB-EA0A-00-000-B00A00-C00BAF-0000A0B
9D 10A 10B 11A 11B 12 13A 13B 13C 14 15 16A 16B 16C 16D 17A 17B 18A 18B 18C 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37

Tag: RTU #5

Job Information

Job Name:	*Swonder Phase 3 - 2025*
Job Number:	*AC2533687*
Site Altitude:	*386 ft*
Refrigerant:	*R-454B*
Design System Charge (oz):	*466 / 678*

Unit Information

Approx. Op./Ship Weights:	*7060 lbs / 7060 lbs (±5%)*
Ambient Temperature (DB/WB):	*95.0 °F / 75.0 °F*
Coil Filter FV / Qty:	*312.5 fpm / 8*
Min. Room Area/Height/Airflow**:	*636 ft² / 7 ft / 1147 SCFM*
Exhaust Airflow/ESP/TSP:	*10000 SCFM / 1.00 in. w.g. / 1.49 in. w.g.*
Outside Air Prefilter FV / Qty:	*134.2 fpm / 6*
Supply Airflow/ESP:	*10000 SCFM / 2.00 in. w.g.*
Outside Airflow:	*1850 SCFM*
Return Temperature (DB/WB):	*75.0 °F / 62.0 °F*

Static Pressure

External:	*2.00 in. w.g.*	Economizer:	*0.18 in. w.g.*
Cooling Coil:	*0.31 in. w.g.*	Heating:	*0.08 in. w.g.*
Filters Clean:	*0.14 in. w.g.*	Cabinet:	*0.04 in. w.g.*
Dirt Allowance:	*0.35 in. w.g.*	Energy Recovery:	*0.16 in. w.g.*
Reheat Coil:	*0.05 in. w.g.*	Total:	*3.15 in. w.g.*

Cooling Section

	Gross	Net
Equivalent Total Capacity:	*394.2 MBH*	*370.6 MBH*
Total Capacity:	*333.0 MBH*	*309.4 MBH*
Sensible Capacity:	*268.5 MBH*	*244.9 MBH*
Latent Capacity:	*64.5 MBH*	
HW Total Cooling Capacity:	*61.2 MBH*	
Mixed Air Temp (DB/WB):	*75.8 °F / 62.5 °F*	
Entering Air Temp (DB/WB):	*75.8 °F / 62.5 °F*	
Lv Air Temp (Coil) (DB/WB):	*50.6 °F / 50.3 °F*	
Lv Air Temp (Unit) (DB/WB):	*52.7 °F / 51.3 °F*	

Supply Air Fan:	*1 x 270D @ 8.63 BHP Ea.*
SA Fan RPM / Width:	*1392 RPM / 6.130 in*
SA Fan FEI:	*1.03*
Exhaust Air Fan:	*1 x RM270-RN @ 4.93 BHP Ea.*
EA Fan RPM / Width:	*1188 RPM / 6.130 in*
EA Fan FEI:	*0.92*
Evaporator Coil:	*32.1 ft² / 6 Rows / 12 FPI*
Evaporator Face Velocity:	*311.1 fpm*
Energy Recovery:	*2 x ERC-5255C-4M*

Heating Section

Preheat Type:	*Std (No Preheat)*
Auxiliary Heating Type:	*Nat. Gas Heat*
Heating Airflow:	*10000 SCFM*
Total Capacity:	*729.0 MBH*
Entering Air Temp (DB/WB):	*71.6 °F / 60.4 °F*
Leaving Air Temp (DB/WB):	*139.0 °F / 79.9 °F*
Consumption:	*900.0 MBH*
Total Turndown Ratio:	*5.0:1*

Re-heat Coil:

Capacity:	*203.2 MBH*
Leaving Air Temp (DB/WB):	*69.7 °F / 58.1 °F*
Relative Humidity:	*49.9%*

Rating Information

Listing Model	*RN-031-3-0-GABY-V0-21-000-A*
Cooling Capacity:	*356.0 MBH*
Cooling EER:	*10.68 BTU/h·W*
Cooling IEER:	*13.62 BTU/h·W*

**Rated in accordance with AHRI Standard 340/360 (I-P)*

Application EER @ Op. Conditions:	***10.2 BTU/h·W***

Unit Rating

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 356

Circuit 1

Rating:	*460V/3Ø/60Hz*	*Minimum Circuit Amp:*	*97*
Unit FLA:	*92*	*Maximum Overcurrent:*	*110*
SCCR:	*10 KAIC*		

	Qty	HP	VAC	Phase	RPM	FLA	RLA
Compressor 1:	1		460	3	3500		19.9
Compressor 2:	1		460	3	3500		21.2
Condenser Fan:	4	1.00	460	1	1100	3.6	
Supply Fan:	1	15.00	460	3	1760	21.0	
Exhaust Fan:	1	10.00	460	3	1760	14.0	
Combustion:	3	0.25	460	1	3200	0.9	
Energy Recovery:	2	0.17	460	1	1075	0.6	

Cabinet Sound Power Levels*

Octave Bands:	63	125	250	500	1000	2000	4000	8000
Discharge LW (dB):	92	91	95	98	93	88	85	82
Return LW (dB):	90	88	89	87	88	83	78	74

*Sound data is generated by a proprietary acoustics model validated through unit testing in accordance with AHRI 260, utilizing tested fan sound data in accordance with AMCA 300.

**The minimum floor area for the Lower Flammability Limit (LFL) is calculated in accordance with UL60335-2-40 4th ed. (operating or storage). For UL60335-2-40 3rd ed. double the airflow and minimum floor area listed.

Unit Rating

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

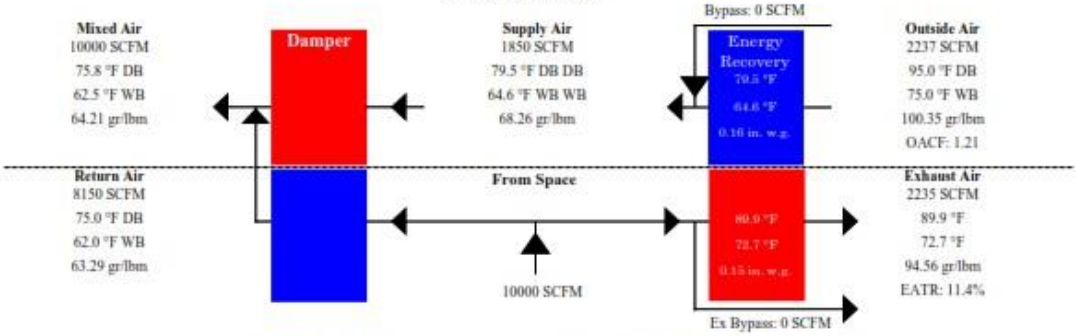
RNA-031-D-A-3-GAB0C-CB3K0:00-0AGAL-KDK-00000-ABNBL-DC-0M0
J-00-E0-C-AR0-EB-EA0A-00-000-B00A00-C00BAF-0000A0B

Tag: RTU #5

Job Name:	**Swonder Phase 3 - 2025**	Energy Recovery Type:	**Total**
Job Number:	**AC2533687**	Energy Recovery Model:	**ERC-5255C-4M**
Site Altitude:	**386 ft**	Energy Recovery Qty:	**2**
Net Supply Airflow Sum/Win:	**1639 SCFM / 1639 SCFM**	Energy Recovery Software Ver:	**1.1.0.0**
Purge Angle:	**10.0°**		

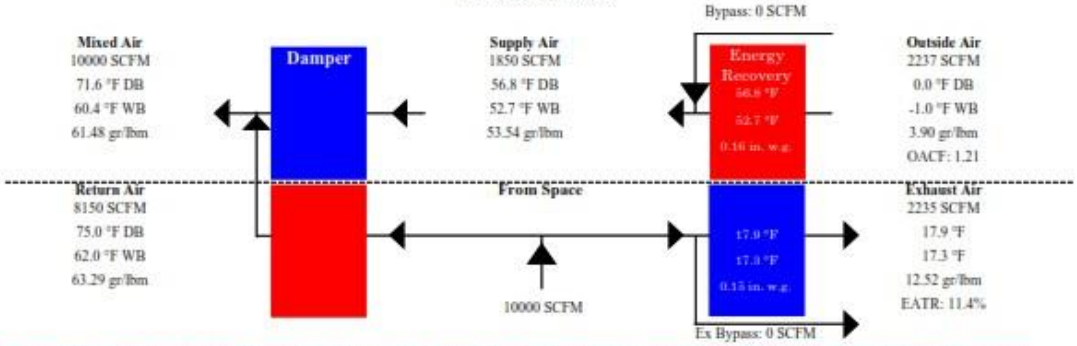
Application Rating is outside the scope of the AHRI ERV Certification Program but is rated in accordance with AHRI Standard 1060.

Summer Conditions



	Cooling/Dehumidification	Heating/Dehumidification	Effectiveness
Total Capacity:	61.2 MBH	0.0 MBH	80.3%
Sensible Capacity:	25.5 MBH	0.0 MBH	75.1%
Latent Capacity:	35.7 MBH	0.0 MBH	85.0%

Winter Conditions



Frost Warning - Conditions for frost forming on the energy recovery exists. Outside air preheat is required to prevent frost formation. Optionally, the return air humidity ratio could be lowered to prevent frost formation. See AAON literature titled 'AAONAIRE ENERGY RECOVERY' for details.

	Cooling/Dehumidification	Heating/Dehumidification	Effectiveness
Total Capacity:	0.0 MBH	154.0 MBH	78.1%
Sensible Capacity:	0.0 MBH	97.7 MBH	75.9%
Latent Capacity:	0.0 MBH	56.3 MBH	85.1%

27.4" STAR Plenum

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

JOB INFORMATION:

Job Name:	*Swonder Phase 3 - 2025*
Job Tag:	*RTU #5*
Date:	*6/4/2025 12:00:00 AM*

WHEEL SPECIFICATION:

Max RPM:	*1800*
Diameter x Qty:	*27.4 in. x 1*
CFM:	*10000*
Inertia:	*16WR²*

OPERATING CONDITIONS

Air Flow:	*10000*
Fan Energy Index (FEI):	*1.03*
Static Pressure:	*3.15 in. Wg*
Relief Dampers DP:	*0 in. Wg*
TSP:	*3.20 in. Wg*
Site Altitude	*386 ft*
TSP @ Sea Level:	*3.20 in. Wg*

MOTOR SELECTION

Rated HP / Bypass:	*15 x 1 / No*
Frame Size:	*254T*
Nominal RPM:	*1760*
VAC/PH/HZ:	*460V/3Ø/60Hz*
Enclosure Type:	*ODP*
Max Inertial Load:	*0 WR²*

FAN PERFORMANCE:

RPM:	*1392*
BHP:	*8.63*
Efficiency:	*57.54%*
Max Duct SP with Blocked Airway:	*0 in. Wg @1392 RPM*

Max Duct SP with Blocked Airway:

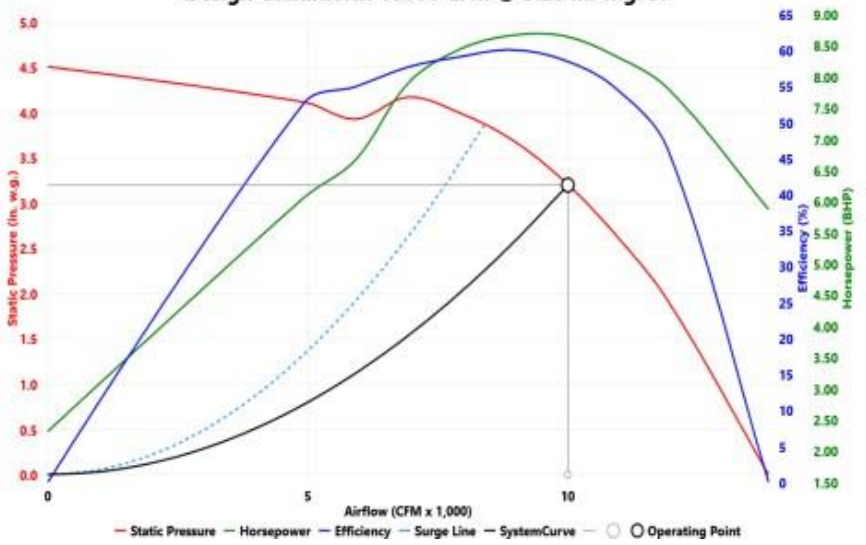
FAN SOUND POWER (Inlet/Outlet)

Octave Band: **(Re 10^-12 watts)**

1	2	3	4	5	6	7	8
90	89	87	87	86	85	83	83
92	90	93	97	94	90	87	84

SOUND POWER A-Weighted: 97 dB

Supply Fan Model: 270D @ 1392 RPM and 100% Width
Design Conditions: 10000 CFM @ 3.20 in. w.g. SP



27.4" STAR Plenum

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

JOB INFORMATION:

Job Name:	*Swonder Phase 3 - 2025*
Job Tag:	*RTU #5*
Date:	*6/4/2025 12:00:00 AM*

WHEEL SPECIFICATION:

Max RPM:	*1800*
Diameter x Qty:	*27.4 in. x 1*
CFM:	*10000*
Inertia:	*14WR²*

OPERATING CONDITIONS

Air Flow:	*10000*
Fan Energy Index (FEI):	*0.92*
Static Pressure:	*1.49 in. Wg*
Relief Dampers DP:	*0 in. Wg*
TSP:	*1.51 in. Wg*
Site Altitude	*386 ft*
TSP @ Sea Level:	*1.51 in. Wg*

MOTOR SELECTION

Rated HP / Bypass:	*10 x 1 / No*
Frame Size:	*215T*
Nominal RPM:	*1760*
VAC/PH/HZ:	*460V/3Ø/60Hz*
Enclosure Type:	*ODP*
Max Inertial Load:	*0 WR²*

FAN PERFORMANCE

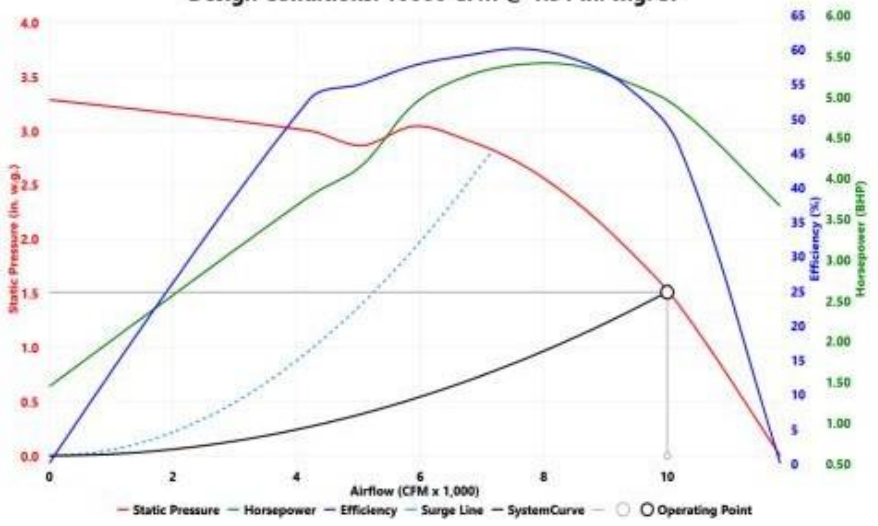
RPM:	*1188*
BHP:	*4.93*
Efficiency:	*47.65%*
Max Duct SP with Blocked Airway:	*0 in. Wg @1188 RPM*
Max Duct SP with Blocked Airway:	

FAN SOUND POWER (Inlet/Outlet)

Octave Band:							(Re 10^{-12} watts)
1	2	3	4	5	6	7	8
1	2	3	4	5	6	7	8
87	86	85	85	84	80	78	78

SOUND POWER A-Weighted: dB

Exhaust Fan Model: RM270 @ 1188 RPM and 100% Width
Design Conditions: 10000 CFM @ 1.51 in. w.g. SP

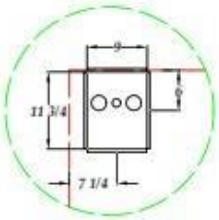


RN UNITS 26-31 TON
AIR COOLED, ENERGY RECOVERY WHEEL, POWER EXHAUST, RETURN AIR FILTER, RNA-D

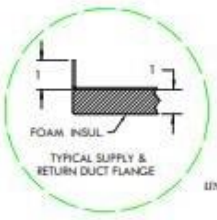
AAON

CLEARANCES	
LOCATION	UNIT SIZE 26-31 TON
RETURN AIR BACK	48
VENT SIDE FRONT	48
LEFT SIDE	48
RIGHT SIDE	70
TOP	UNOBSTRUCTED

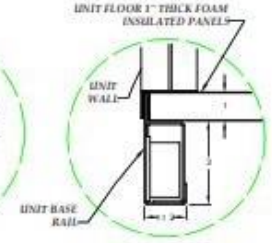
NOTE: RIGHT AND LEFT SIDE UNIT CLEARANCES ARE INTERCHANGEABLE ON UNITS THAT DO NOT HAVE THE HYDRONIC HEATING OPTION. (UNITS WITH HYDRONIC HEAT MUST HAVE 70" RIGHT SIDE ACCESS FOR SERVICE.)



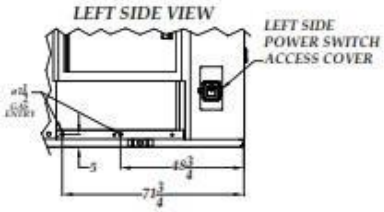
DETAIL A
UTILITY ENTRY

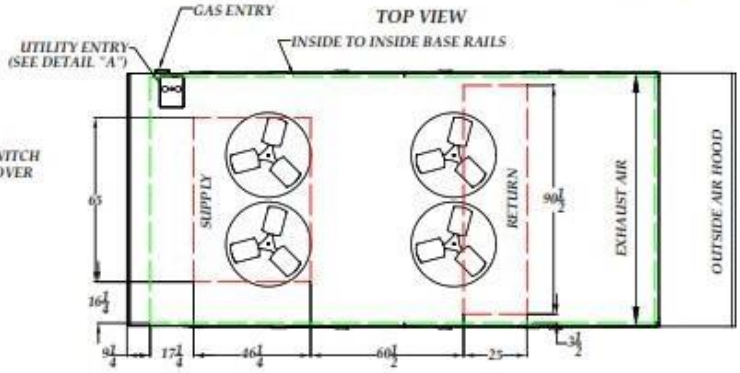


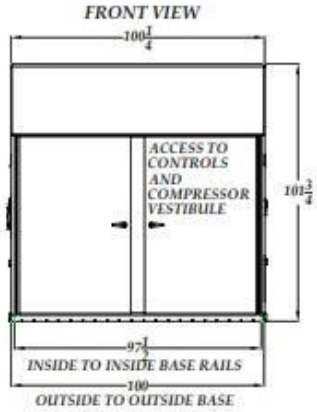
TYPICAL SUPPLY & RETURN DUCT FLANGE
DETAIL B

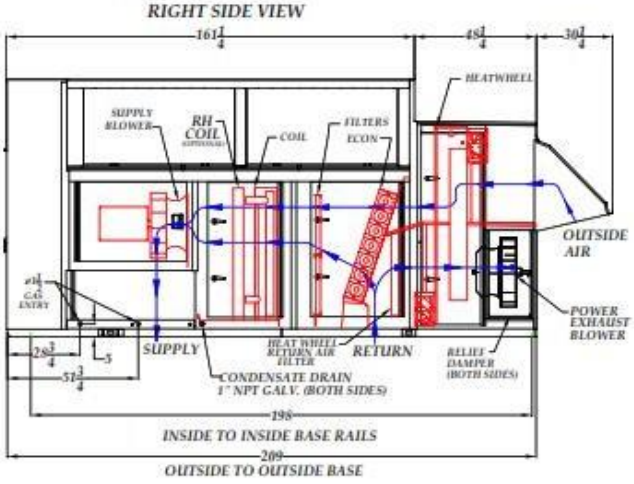


BASE RAIL CLEARANCE









CAT000549 RNA-D REV:A 06/26/24 JWC
ALL DIMENSIONS ARE IN INCHES

FIELD GAS PIPING DETAILS

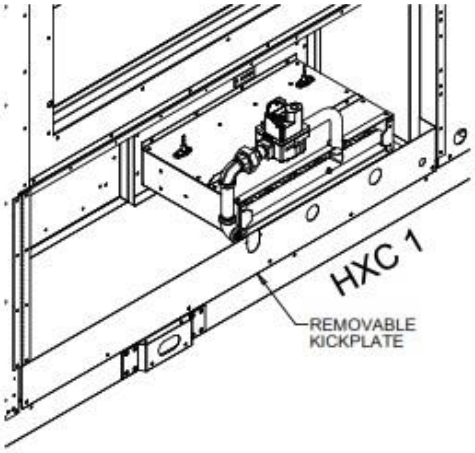
RNA SERIES D - CABINET
26-70 TON

900 MBH
2-4 STAGE, MODULATING

CAT000433A RNA-D REV A 04/26/23 JAS
ALL DIMENSIONS ARE IN INCHES

Field gas piping is required to the internal gas valves.
Piping should be installed adhering to building codes.
Perform leak check prior to operation.

Reference IOM for additonal information,
and details on optional gas entry through base.

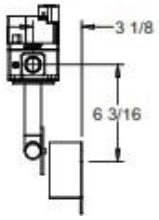


RIGHT SIDE VIEW

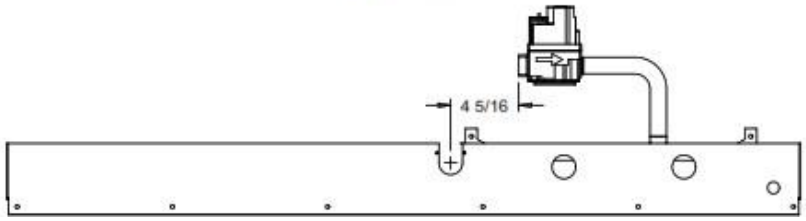
HEAT
EXCHANGER 1

TOP

SIDE



FRONT



FIELD GAS PIPING DETAILS

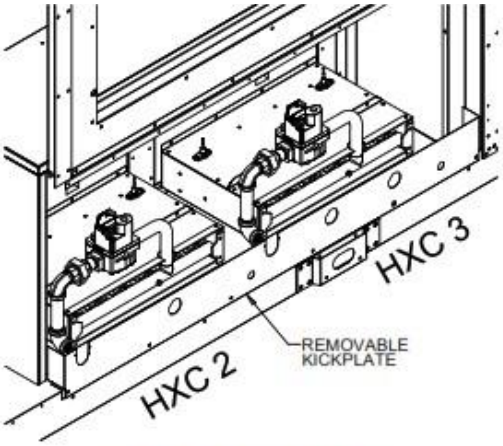
RNA SERIES D - CABINET
26-70 TON

900 MBH
2-4 STAGE, MODULATING

CAT000433B RNA-D REV A 04/26/23 JAS
ALL DIMENSIONS ARE IN INCHES

Field gas piping is required to the internal gas valves.
Piping should be installed adhering to building codes.
Perform leak check prior to operation.

Reference IOM for additonal information,
and details on optional gas entry through base.

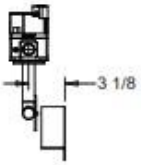


LEFT SIDE VIEW

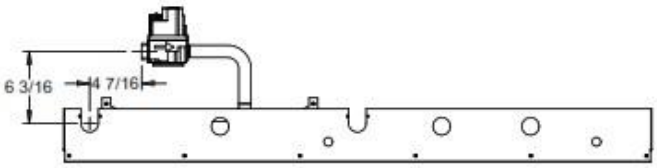
HEAT
EXCHANGER 2

TOP

SIDE

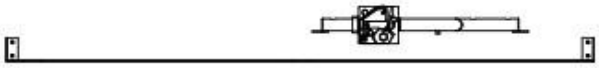


FRONT

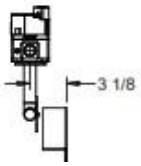


HEAT
EXCHANGER 3

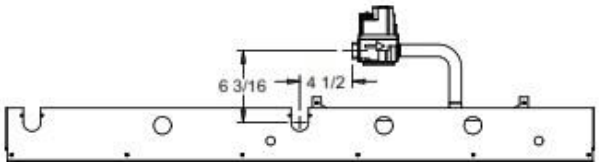
TOP



SIDE

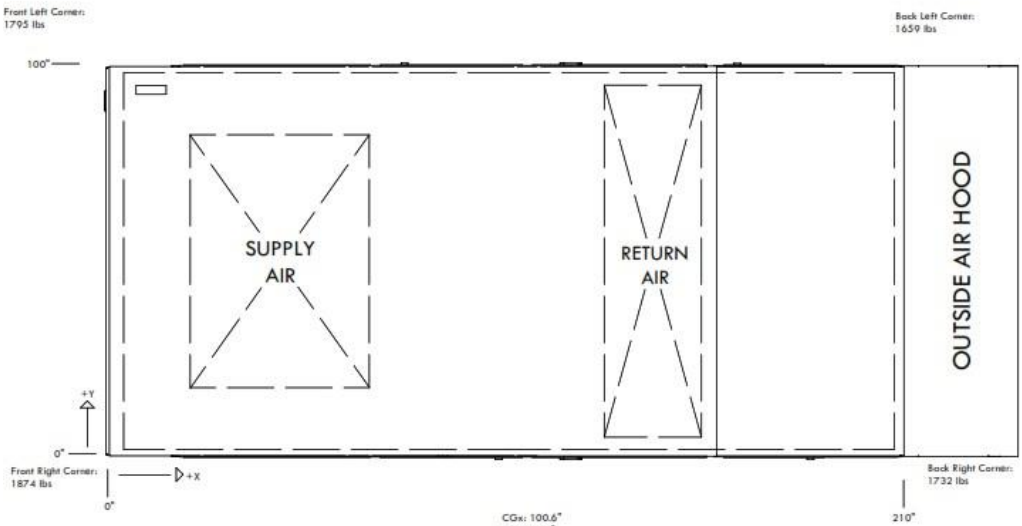


FRONT



RND CABINET
AIR COOLED CONDENSING UNIT
ENERGY RECOVERY SECTION

RNA-031-D-A-3-GAB0C-CB3K0:00-0AGAL-KDK-00000-ABNBL-DC-0M0J-00-E0-C-AR0-EB-EA0A-00-000-B00A00-C00BAF-0000A0B



Disclaimer:
This weight estimate does not account for any SPAs.

RTU-6 (RNA-014)

Unit Rating

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 356

**RNA-014-C-A-3-GAB0C-CB1K0:00-0FFAH-KBA-00000-ABLBH-DC-0M0
J-00-E0-C-AN0-EB-EA0A-00-000-B00A00-C00BAF-0000A0B**

Tag: RTU #6

Job Information

Job Name:	*Swonder Phase 3 - 2025*
Job Number:	*AC2533687*
Site Altitude:	*386 ft*
Refrigerant:	*R-454B*
Design System Charge (oz):	*273 / 414*

Unit Information

Approx. Op./Ship Weights:	*3556 lbs / 3556 lbs (±5%)*
Ambient Temperature (DB/WB):	*95.0 °F / 75.0 °F*
Coil Filter FV / Qty:	*144.0 fpm / 6*
Min. Room Area/Height/Airflow**:	*389 ft² / 7 ft / 701 SCFM*
Exhaust Airflow/ESP/TSP:	*3000 SCFM / 1.00 in. w.g. / 1.23 in. w.g.*
Outside Air Prefilter FV / Qty:	*81.5 fpm / 4*
Supply Airflow/ESP:	*3000 SCFM / 2.00 in. w.g.*
Outside Airflow:	*800 SCFM*
Return Temperature (DB/WB):	*75.0 °F / 62.0 °F*

Static Pressure

External:	*2.00 in. w.g.*	Economizer:	*0.10 in. w.g.*
Cooling Coil:	*0.10 in. w.g.*	Heating:	*0.06 in. w.g.*
Filters Clean:	*0.06 in. w.g.*	Cabinet:	*0.04 in. w.g.*
Dirt Allowance:	*0.35 in. w.g.*	Energy Recovery:	*0.24 in. w.g.*
Reheat Coil:	*0.02 in. w.g.*	Total:	*2.74 in. w.g.*

Cooling Section

	Gross	Net
Equivalent Total Capacity:	*159.4 MBH*	*153.4 MBH*
Total Capacity:	*130.6 MBH*	*124.6 MBH*
Sensible Capacity:	*93.6 MBH*	*87.6 MBH*
Latent Capacity:	*37.0 MBH*	
HW Total Cooling Capacity:	*28.8 MBH*	
Mixed Air Temp (DB/WB):	*75.5 °F / 62.6 °F*	
Entering Air Temp (DB/WB):	*75.5 °F / 62.6 °F*	
Lv Air Temp (Coil) (DB/WB):	*46.1 °F / 46.1 °F*	
Lv Air Temp (Unit) (DB/WB):	*47.9 °F / 46.9 °F*	

Supply Air Fan:	*1 x 245D60 @ 2.13 BHP Ea.*
SA Fan RPM / Width:	*1284 RPM / 3.290 in*
SA Fan FEI:	*1.24*
Exhaust Air Fan:	*1 x RM220A-RN @ 1.22 BHP Ea.*
EA Fan RPM / Width:	*966 RPM / 4.930 in*
EA Fan FEI:	*1.07*
Evaporator Coil:	*19.9 ft² / 6 Rows / 12 FPI*
Evaporator Face Velocity:	*151.0 fpm*
Energy Recovery:	*1 x ERC-5245*

Heating Section

Preheat Type:	*Std (No Preheat)*
Auxiliary Heating Type:	*Nat. Gas Heat*
Heating Airflow:	*3000 SCFM*
Total Capacity:	*218.7 MBH*
Entering Air Temp (DB/WB):	*72.7 °F / 60.5 °F*
Leaving Air Temp (DB/WB):	*140.1 °F / 80.0 °F*
Consumption:	*270.0 MBH*
Total Turndown Ratio:	*3.0:1*

Re-heat Coil:

Capacity:	*80.5 MBH*
Leaving Air Temp (DB/WB):	*71.5 °F / 56.9 °F*
Relative Humidity:	*40.2%*

Rating Information

Listing Model	*RN-014-3-0-GABY-V0-21-000-A*
Cooling Capacity:	*164.0 MBH*
Cooling EER:	*11.8 BTU/h·W*
Cooling IEER:	*17.0 BTU/h·W*

**Rated in accordance with AHRI Standard 340/360 (I-P)*

Application EER @ Op. Conditions:	***11.8 BTU/h·W***

Unit Rating

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

Circuit 1

Rating:	460V/3Ø/60Hz	Minimum Circuit Amp:	41
Unit FLA:	38	Maximum Overcurrent:	45
SCCR:	10 KAIC		

	Qty	HP	VAC	Phase	RPM	FLA	RLA
Compressor 1:	1		460	3			9.0
Compressor 2:	1		460	3			9.1
Condenser Fan:	2	1.00	460	1	1100	3.6	
Supply Fan:	1	5.00	460	3	1760	7.6	
Exhaust Fan:	1	3.00	460	3	1760	4.8	
Combustion:	1	0.25	460	1	3200	0.9	
Energy Recovery:	1	0.17	460	1	1075	0.6	

Cabinet Sound Power Levels*

Octave Bands:	63	125	250	500	1000	2000	4000	8000
Discharge LW (dB):	88	88	90	93	91	89	83	76
Return LW (dB):	81	82	77	70	70	67	62	55

*Sound data is generated by a proprietary acoustics model validated through unit testing in accordance with AHRI 260, utilizing tested fan sound data in accordance with AMCA 300.

**The minimum floor area for the Lower Flammability Limit (LFL) is calculated in accordance with UL60335-2-40 4th ed. (operating or storage). For UL60335-2-40 3rd ed. double the airflow and minimum floor area listed.

Unit Rating

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

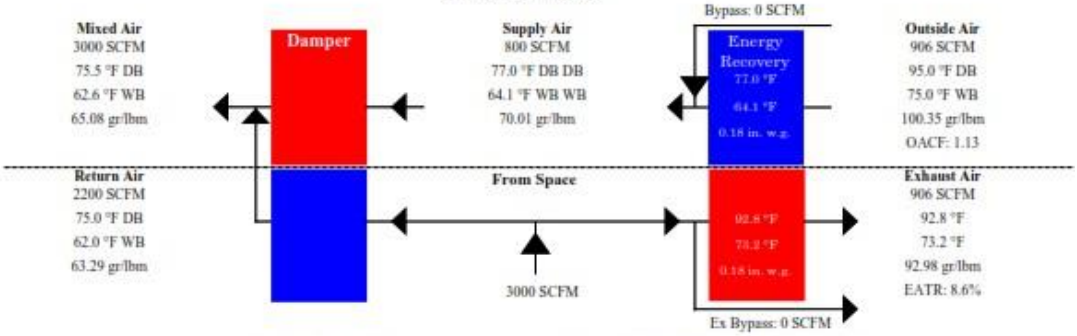
```
RNA-014-C-A-3-GAB0C-CB1K0:00-0FFAH-KBA-00000-ABLBH-DC-0M0
J-00-E0-C-AN0-EB-EA0A-00-000-B00A00-C00BAF-0000A0B
```

Tag: RTU #6

Job Name:	**Swonder Phase 3 - 2025**	Energy Recovery Type:	**Total**
Job Number:	**AC2533687**	Energy Recovery Model:	**ERC-5245**
Site Altitude:	**386 ft**	Energy Recovery Qty:	**1**
Net Supply Airflow Sum/Win:	**731 SCFM / 731 SCFM**	Energy Recovery Software Ver:	**1.1.0.0**
Purge Angle:	**10.0°**		

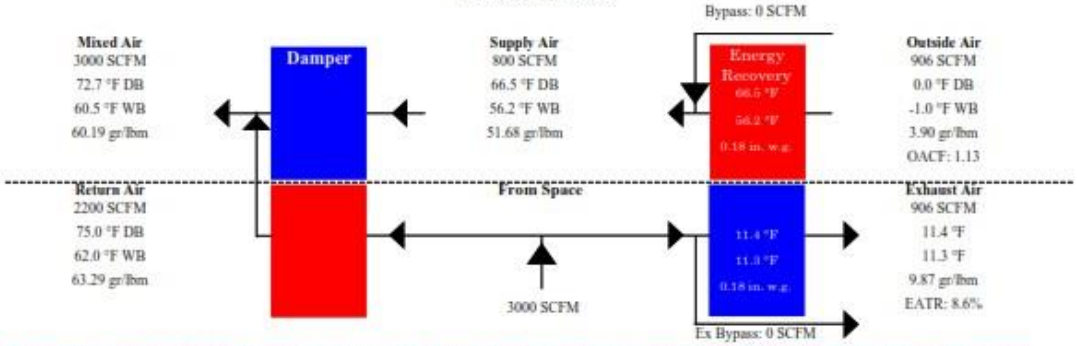
Application Rating is outside the scope of the AHRI ERV Certification Program but is rated in accordance with AHRI Standard 1060.

Summer Conditions



	Cooling/Dehumidification	Heating/Dehumidification	Effectiveness
Total Capacity:	28.8 MBH	0.0 MBH	84.3%
Sensible Capacity:	13.6 MBH	0.0 MBH	89.2%
Latent Capacity:	15.2 MBH	0.0 MBH	80.3%

Winter Conditions



Frost Warning - Conditions for frost forming on the energy recovery exists. Outside air preheat is required to prevent frost formation. Optionally, the return air humidity ratio could be lowered to prevent frost formation. See AAON literature titled 'AAONAIRE ENERGY RECOVERY' for details.

	Cooling/Dehumidification	Heating/Dehumidification	Effectiveness
Total Capacity:	0.0 MBH	75.2 MBH	85.9%
Sensible Capacity:	0.0 MBH	51.3 MBH	89.3%
Latent Capacity:	0.0 MBH	23.8 MBH	80.3%

24.5" STAR Plenum

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

JOB INFORMATION:

Job Name:	*Swonder Phase 3 - 2025*
Job Tag:	*RTU #6*
Date:	*6/4/2025 12:00:00 AM*

WHEEL SPECIFICATION:

Max RPM:	*1800*
Diameter x Qty:	*24.5 in. x 1*
CFM:	*3000*
Inertia:	*10WR²*

OPERATING CONDITIONS

Air Flow:	*3000*
Fan Energy Index (FEI):	*1.24*
Static Pressure:	*2.74 in. Wg*
Relief Dampers DP:	*0 in. Wg*
TSP:	*2.78 in. Wg*
Site Altitude	*386 ft*
TSP @ Sea Level:	*2.78 in. Wg*

MOTOR SELECTION

Rated HP / Bypass:	*5 x 1 / No*
Frame Size:	*184T*
Nominal RPM:	*1760*
VAC/PH/HZ:	*460V/3Ø/60Hz*
Enclosure Type:	*ODP*
Max Inertial Load:	*0 WR²*

FAN PERFORMANCE:

RPM:	*1284*
BHP:	*2.13*
Efficiency:	*60.84%*
Max Duct SP with Blocked Airway:	*0 in. Wg @1284 RPM*

Max Duct SP with Blocked Airway:

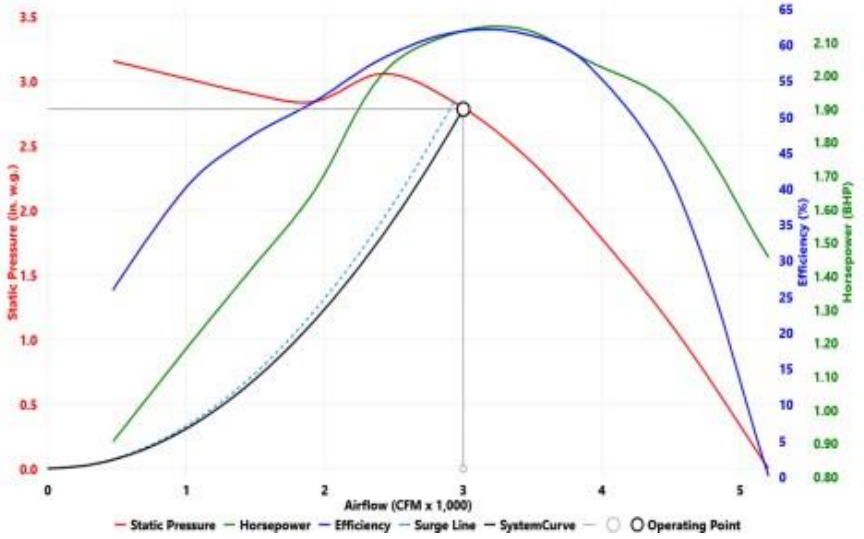
FAN SOUND POWER (Inlet/Outlet)

Octave Band: **(Re 10^-12 watts)**

1	2	3	4	5	6	7	8
88	86	86	85	82	81	78	74
88	87	90	94	93	91	86	79

SOUND POWER A-Weighted: 96 dB

Supply Fan Model: 245D60 @ 1284 RPM and 84% Width
Design Conditions: 3000 CFM @ 2.78 in. w.g. SP



22" STAR Plenum

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

JOB INFORMATION:

Job Name:	*Swonder Phase 3 - 2025*
Job Tag:	*RTU #6*
Date:	*6/4/2025 12:00:00 AM*

WHEEL SPECIFICATION:

Max RPM:	*2200*
Diameter x Qty:	*22 in. x 1*
CFM:	*3000*
Inertia:	*5WR²*

OPERATING CONDITIONS

Air Flow:	*3000*
Fan Energy Index (FEI):	*1.07*
Static Pressure:	*1.23 in. Wg*
Relief Dampers DP:	*0 in. Wg*
TSP:	*1.25 in. Wg*
Site Altitude	*386 ft*
TSP @ Sea Level:	*1.25 in. Wg*

MOTOR SELECTION

Rated HP / Bypass:	*3 x 1 / No*
Frame Size:	*182T*
Nominal RPM:	*1760*
VAC/PH/HZ:	*460V/3Ø/60Hz*
Enclosure Type:	*ODP*
Max Inertial Load:	*0 WR²*

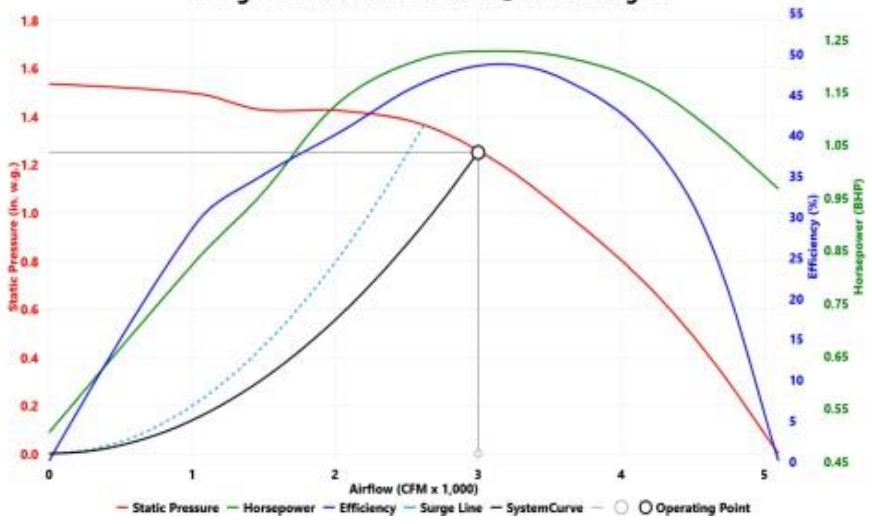
FAN PERFORMANCE

RPM:	*966*
BHP:	*1.22*
Efficiency:	*47.68%*
Max Duct SP with Blocked Airway:	*0 in. Wg @966 RPM*
Max Duct SP with Blocked Airway:	

FAN SOUND POWER (Inlet/Outlet)

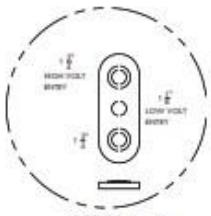
Octave Band:								**(Re 10^-12 watts)**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
79	82	79	73	70	68	63	57	**SOUND POWER A-Weighted: dB**

Exhaust Fan Model: RM220A @ 966 RPM and 100% Width
Design Conditions: 3000 CFM @ 1.25 in. w.g. SP



RN SERIES
C - CABINET WITH ECONOMIZER ~ 16-30 TON
ENERGY RECOVERY SECTION AND POWER EXHAUST

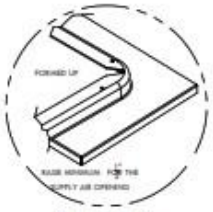
CLEARANCES	
LOCATION	* UNIT SIZE * 16 - 30 TON
OUTSIDE AIR (BACK)	48
CONTROLS SIDE (FRONT)	48
LEFT SIDE	6
RIGHT SIDE	60
TOP	UNOBSTRUCTED



DETAIL A

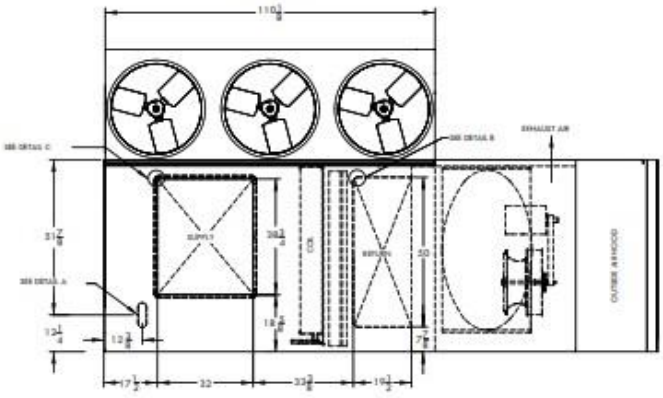
DETAIL B

NUMBER OF CONDENSER FANS
16,18 & 20 TON - 2 FANS
25 & 30 TON - 3 FANS

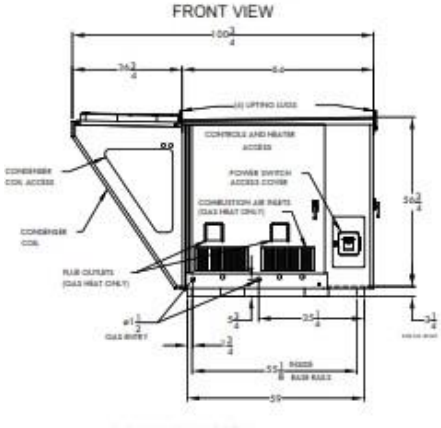


DETAIL C

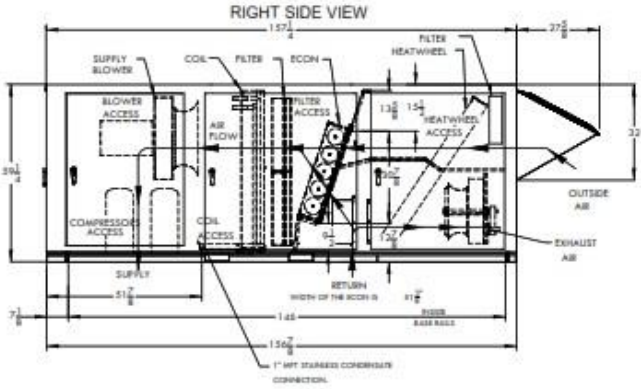
TOP VIEW



FRONT VIEW



RIGHT SIDE VIEW



FIELD GAS PIPING DETAILS

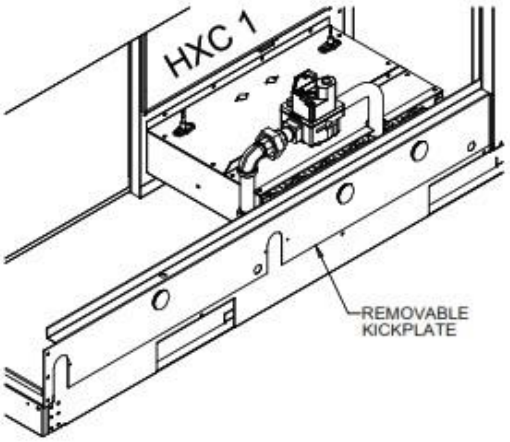
RN SERIES C - CABINET
16-30 TON

270 MBH
2 STAGE, MODULATING

CAT000427 RNC REV A 04/25/23 JAS
ALL DIMENSIONS ARE IN INCHES

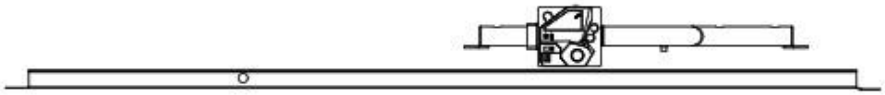
Field gas piping is required to the internal gas valves.
Piping should be installed adhering to building codes.
Perform leak check prior to operation.

Reference IOM for additonal information,
and details on optional gas entry through base.

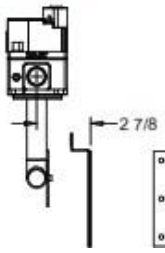


HEAT EXCHANGER 1

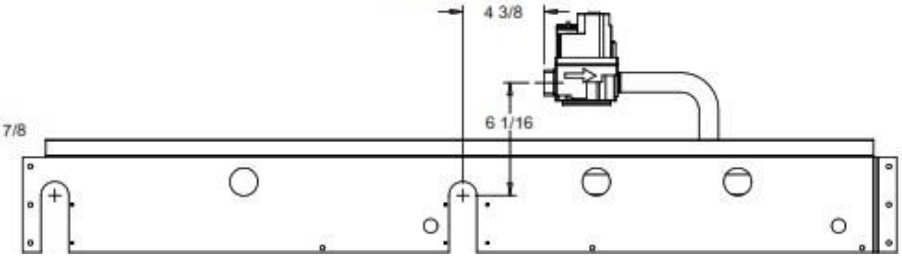
TOP



SIDE



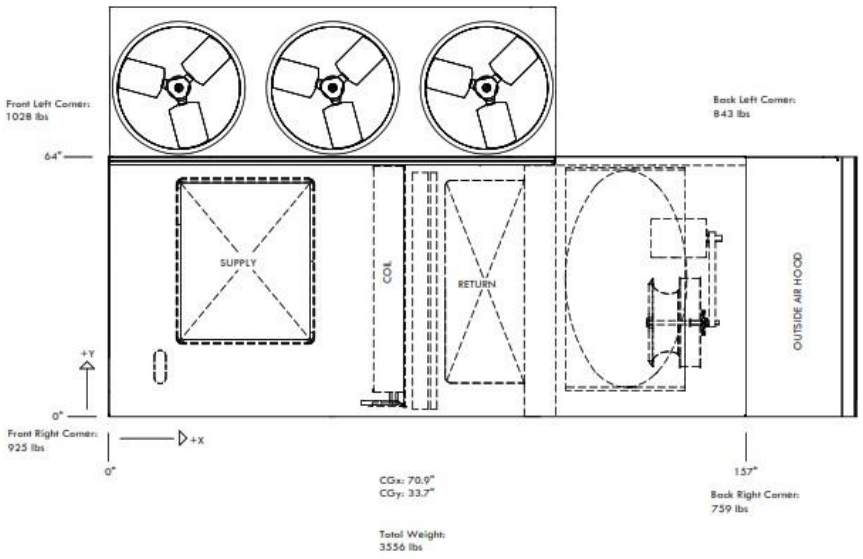
FRONT



RNC CABINET
AIR COOLED CONDENSING UNIT
WITH ENERGY RECOVERY SECTION

AAON

RNA-014-C-A-3-GAB0C-CB1K0:00-0FFAH-KBA-00000-ABLBH-DC-0M0J-00-E0-C-AN0-EB-EA0A-00-000-B00A00-C00BAF-0000A0B



Disclaimer:
This weight estimate does not account for any SPAs.

RTU-7 (RNA-016)

Unit Rating

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

RNA-016-C-A-3-GAB0C-CB2K0:00-0AG0H-E00-00000-00000-DC-000
J-00-E0-C-AN0-EB-EA0A-00-000-BA0A00-E000AF-000000B

Tag: RTU #7

Job Information

Job Name:	*Swonder Phase 3 - 2025*
Job Number:	*AC2533687*
Site Altitude:	*386 ft*
Refrigerant:	*R-454B*
Design System Charge (oz):	*273 / 414*

Static Pressure

External:	*1.10 in. w.g.*
Cooling Coil:	*0.23 in. w.g.*
Filters Clean:	*0.09 in. w.g.*
Dirt Allowance:	*0.35 in. w.g.*
Reheat Coil:	*0.04 in. w.g.*

Cooling Section

	Gross	Net
Total Capacity:	*189.6 MBH*	*179.3 MBH*
Sensible Capacity:	*146.1 MBH*	*135.8 MBH*
Latent Capacity:	*43.5 MBH*	
Mixed Air Temp (DB/WB):	*78.1 °F / 64.3 °F*	
Entering Air Temp (DB/WB):	*78.1 °F / 64.3 °F*	
Lv Air Temp (Coil) (DB/WB):	*51.3 °F / 51.1 °F*	
Lv Air Temp (Unit) (DB/WB):	*53.1 °F / 51.9 °F*	

Supply Air Fan:	*1 x 270 @ 3.62 BHP Ea.*
SA Fan RPM / Width:	*1075 RPM / 6.130 in*
SA Fan FEI:	*1.00*
Evaporator Coil:	*19.9 ft² / 6 Rows / 12 FPI*
Evaporator Face Velocity:	*259.3 fpm*

Unit Information

Approx. Op./Ship Weights:	*2888 lbs / 2888 lbs (±5%)*
Ambient Temperature (DB/WB):	*95.0 °F / 75.0 °F*
Coil Filter FV / Qty:	*247.2 fpm / 6*
Min. Room Area/Height/Airflow**:	*389 ft² / 7 ft / 701 SCFM*
Outside Air Prefilter FV / Qty:	*72.0 fpm / 4*
Supply Airflow/ESP:	*5150 SCFM / 1.10 in. w.g.*
Outside Airflow:	*800 SCFM*
Return Temperature (DB/WB):	*75.0 °F / 62.0 °F*
Economizer:	*0.14 in. w.g.*
Heating:	*0.14 in. w.g.*
Cabinet:	*0.11 in. w.g.*
Total:	*2.20 in. w.g.*

Heating Section

Preheat Type:	*Std (No Preheat)*
Auxiliary Heating Type:	*Nat. Gas Heat*
Heating Airflow:	*5150 SCFM*
Total Capacity:	*328.1 MBH*
Entering Air Temp (DB/WB):	*63.3 °F / 55.5 °F*
Leaving Air Temp (DB/WB):	*122.3 °F / 74.6 °F*
Consumption:	*405.0 MBH*
Total Turndown Ratio:	*4.3:1*

Re-heat Coil:

Capacity:	*112.7 MBH*
Leaving Air Temp (DB/WB):	*72.0 °F / 59.4 °F*
Relative Humidity:	*47.6%*

Rating Information

Listing Model	*RN-016-3-0-GABY-V0-21-000-A*
Cooling Capacity:	*190.0 MBH*
Cooling EER:	*11.76 BTU/h·W*
Cooling IEER:	*15.78 BTU/h·W*

**Rated in accordance with AHRI Standard 340/360 (I-P)*

Application EER @ Op. Conditions: ***10.2 BTU/h·W***

Electrical Data

Circuit 1

Rating:	*460V/3Ø/60Hz*	*Minimum Circuit Amp:*	*38*
Unit FLA:	*35*	*Maximum Overcurrent:*	*50*
SCCR:	*10 KAIC*		

	Qty	HP	VAC	Phase	RPM	FLA	RLA
Compressor 1:	*1*		*460*	*3*			*12.8*
Compressor 2:	*1*		*460*	*3*			*11.0*
Condenser Fan:	*2*	*0.75*	*460*	*3*	*1080*	*1.8*	
Supply Fan:	*1*	*5.00*	*460*	*3*	*1170*	*7.6*	
Combustion:	*2*	*0.25*	*460*	*1*	*3200*	*0.9*	

Unit Rating

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

Cabinet Sound Power Levels*

Octave Bands:	63	125	250	500	1000	2000	4000	8000
Discharge LW (dB):	83	83	85	84	81	82	79	75
Return LW (dB):	71	70	66	61	63	61	58	51

*Sound data is generated by a proprietary acoustics model validated through unit testing in accordance with AHRI 260, utilizing tested fan sound data in accordance with AMCA 300.

***The minimum floor area for the Lower Flammability Limit (LFL) is calculated in accordance with UL60335-2-40 4th ed. (operating or storage). For UL60335-2-40 3rd ed. double the airflow and minimum floor area listed.*

27.4" STAR Plenum

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

JOB INFORMATION:

Job Name:	*Swonder Phase 3 - 2025*
Job Tag:	*RTU #7*
Date:	*6/4/2025 12:00:00 AM*

OPERATING CONDITIONS

Air Flow:	*5150*
Fan Energy Index (FEI):	*1.00*
Static Pressure:	*2.20 in. Wg*
Relief Dampers DP:	*0 in. Wg*
TSP:	*2.23 in. Wg*
Site Altitude	*386 ft*
TSP @ Sea Level:	*2.23 in. Wg*

FAN PERFORMANCE:

RPM:	*1075*
BHP:	*3.62*
Efficiency:	*49.34%*
Max Duct SP with Blocked Airway:	*0 in. Wg @1075 RPM*

Max Duct SP with Blocked Airway:

WHEEL SPECIFICATION:

Max RPM:	*1800*
Diameter x Qty:	*27.4 in. x 1*
CFM:	*5150*
Inertia:	*16WR²*

MOTOR SELECTION

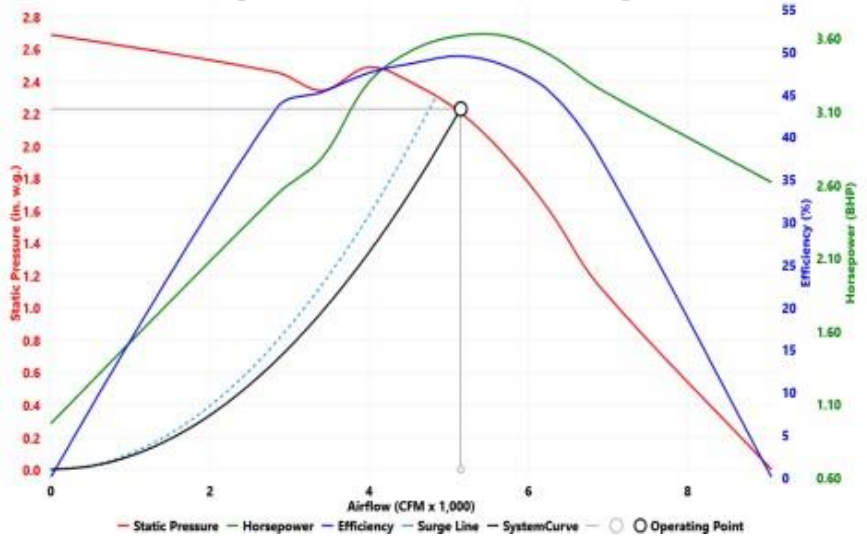
Rated HP / Bypass:	*5 x 1 / No*
Frame Size:	*215T*
Nominal RPM:	*1170*
VAC/PH/HZ:	*460V/3Ø/60Hz*
Enclosure Type:	*ODP*
Max Inertial Load:	*0 WR²*

FAN SOUND POWER (Inlet/Outlet)

Octave Band:				(Re 10^-12 watts)			
1	2	3	4	5	6	7	8
81	79	77	76	77	77	77	76
83	83	85	85	83	84	82	78

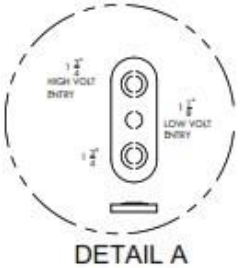
SOUND POWER A-Weighted: 90 dB

Supply Fan Model: 270 @ 1075 RPM and 75% Width
Design Conditions: 5150 CFM @ 2.23 in. w.g. SP



RN SERIES
C - CABINET WITH ECONOMIZER ~ 16-30 TON

CLEARANCES	
LOCATION	• UNIT SIZE • 16 - 30 TON
OUTSIDE AIR (BACK)	48
CONTROLS SIDE (FRONT)	48
LEFT SIDE	6
RIGHT SIDE	60
TOP	UNOBSTRUCTED



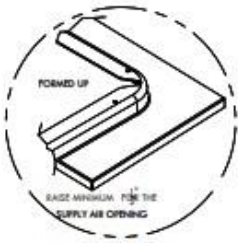
DETAIL A

DETAIL B

NUMBER OF CONDENSER FANS

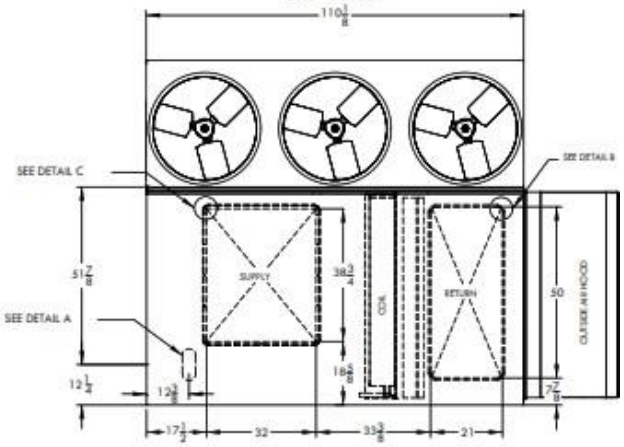
16,18 & 20 TON - 2 FANS

25 & 30 TON - 3 FANS

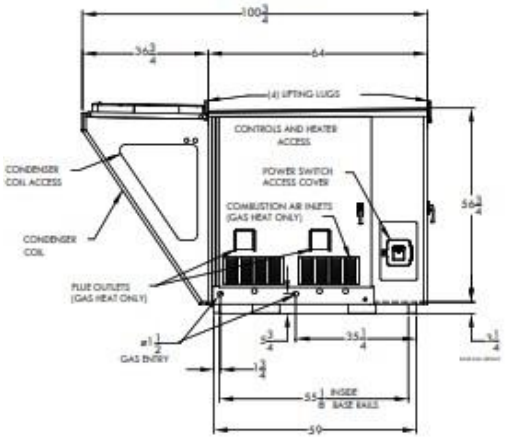


DETAIL C

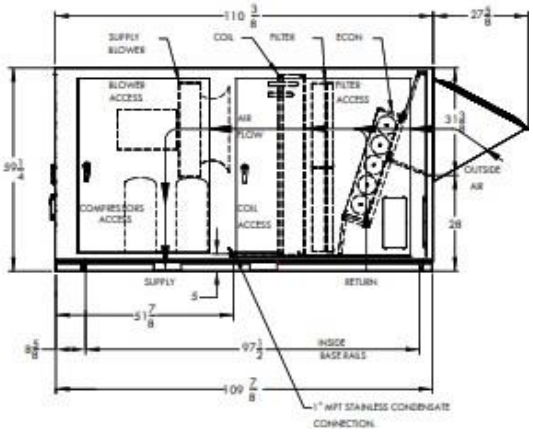
TOP VIEW



FRONT VIEW



RIGHT SIDE VIEW



RNC-00002 REVJE 12/27/22 JWC

FIELD GAS PIPING DETAILS

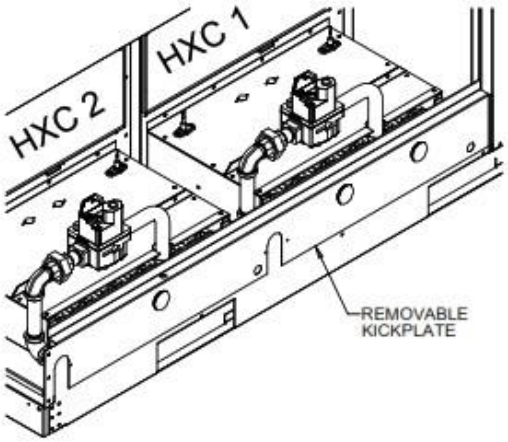
RN SERIES C - CABINET
16-30 TON

405/540 MBH
2-4 STAGE, MODULATING

CAT000429 RNC REV A 04/25/23 JAS
ALL DIMENSIONS ARE IN INCHES

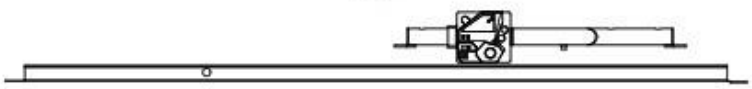
Field gas piping is required to the internal gas valves.
Piping should be installed adhering to building codes.
Perform leak check prior to operation.

Reference IOM for additonal information,
and details on optional gas entry through base.

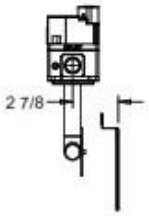


HEAT EXCHANGER 1

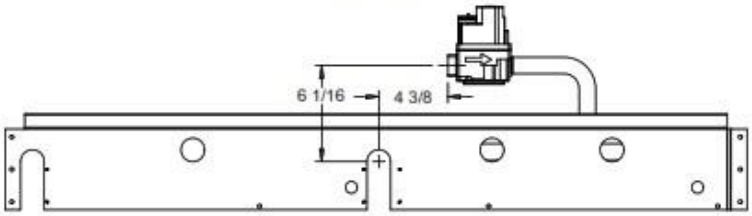
TOP



SIDE

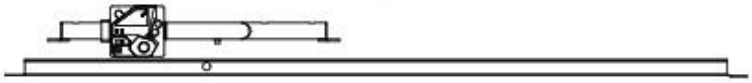


FRONT



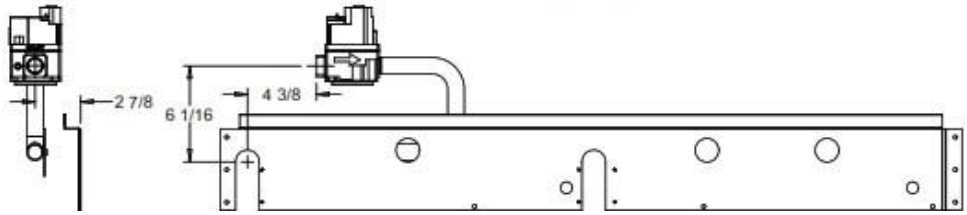
HEAT EXCHANGER 2

TOP



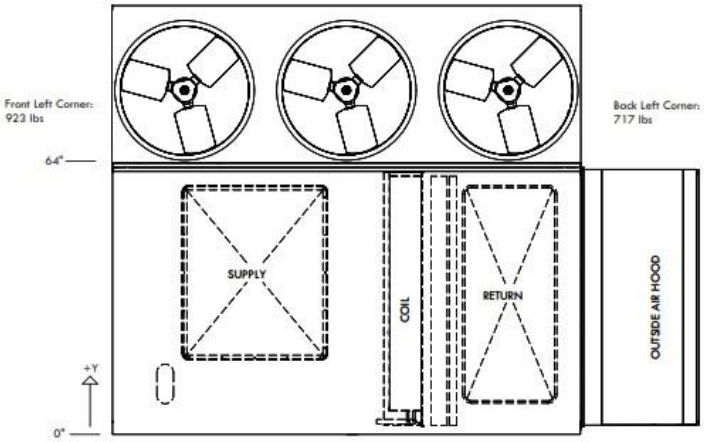
SIDE

FRONT



RNC CABINET
AIR COOLED CONDENSING UNIT

RNA-016-C-A-3-GAB0C-CB2K0:00-0AG0H-E00-00000-00000-DC-000J-00-E0-C-AN0-EB-EA0A-00-000-BA0A00-E000AF-000000B



Disclaimer:
This weight estimate does not account for any SPAs.

RTU-8 (RNA-016)

Unit Rating

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

**RNA-016-C-A-3-GAB0C-CB1K0:00-0FG0H-E00-00000-00000-DC-000
J-00-E0-C-AN0-EB-EA0A-00-000-BA0A00-E000AF-000000B**

Tag: RTU #8

Job Information

Job Name:	*Swonder Phase 3 - 2025*
Job Number:	*AC2533687*
Site Altitude:	*386 ft*
Refrigerant:	*R-454B*
Design System Charge (oz):	*273 / 414*

Unit Information

Approx. Op./Ship Weights:	*2863 lbs / 2863 lbs (±5%)*
Ambient Temperature (DB/WB):	*95.0 °F / 75.0 °F*
Coil Filter FV / Qty:	*192.0 fpm / 6*
Min. Room Area/Height/Airflow**:	*389 ft² / 7 ft / 701 SCFM*
Outside Air Prefilter FV / Qty:	*90.0 fpm / 4*
Supply Airflow/ESP:	*4000 SCFM / 1.10 in. w.g.*
Outside Airflow:	*1000 SCFM*
Return Temperature (DB/WB):	*75.0 °F / 62.0 °F*

Static Pressure

External:	*1.10 in. w.g.*	Economizer:	*0.10 in. w.g.*
Cooling Coil:	*0.17 in. w.g.*	Heating:	*0.09 in. w.g.*
Filters Clean:	*0.07 in. w.g.*	Cabinet:	*0.05 in. w.g.*
Dirt Allowance:	*0.35 in. w.g.*	Total:	*1.96 in. w.g.*
Reheat Coil:	*0.03 in. w.g.*		

Cooling Section

	Gross	Net
Total Capacity:	*184.1 MBH*	*178.9 MBH*
Sensible Capacity:	*130.1 MBH*	*124.9 MBH*
Latent Capacity:	*54.0 MBH*	
Mixed Air Temp (DB/WB):	*80.0 °F / 65.6 °F*	
Entering Air Temp (DB/WB):	*80.0 °F / 65.6 °F*	
Lv Air Temp (Coil) (DB/WB):	*49.2 °F / 49.1 °F*	
Lv Air Temp (Unit) (DB/WB):	*50.3 °F / 49.6 °F*	
Supply Air Fan:	*1 x 270D60 @ 1.83 BHP Ea.*	
SA Fan RPM / Width:	*1005 RPM / 3.680 in*	
SA Fan FEI:	*1.43*	
Evaporator Coil:	*19.9 ft² / 6 Rows / 12 FPI*	
Evaporator Face Velocity:	*201.4 fpm*	

Heating Section

Preheat Type:	*Std (No Preheat)*
Auxiliary Heating Type:	*Nat. Gas Heat*
Heating Airflow:	*4000 SCFM*
Total Capacity:	*218.7 MBH*
Entering Air Temp (DB/WB):	*56.3 °F / 51.2 °F*
Leaving Air Temp (DB/WB):	*106.9 °F / 69.3 °F*
Consumption:	*270.0 MBH*
Total Turndown Ratio:	*3.0:1*

Re-heat Coil:

Capacity:	*96.1 MBH*
Leaving Air Temp (DB/WB):	*72.0 °F / 58.4 °F*
Relative Humidity:	*44.1%*

Rating Information

Listing Model	*RN-016-3-0-GABY-V0-21-000-A*
Cooling Capacity:	*190.0 MBH*
Cooling EER:	*11.76 BTU/h·W*
Cooling IEER:	*15.78 BTU/h·W*

**Rated in accordance with AHRI Standard 340/360 (I-P)*

Application EER @ Op. Conditions: ***11.2 BTU/h·W***

Electrical Data

Circuit 1

Rating:	*460V/3Ø/60Hz*	*Minimum Circuit Amp:*	*38*
Unit FLA:	*35*	*Maximum Overcurrent:*	*50*
SCCR:	*10 KAIC*		

	Qty	HP	VAC	Phase	RPM	FLA	RLA
Compressor 1:	1		460	3			12.8
Compressor 2:	1		460	3			11.0
Condenser Fan:	2	0.75	460	3	1080	1.8	
Supply Fan:	1	5.00	460	3	1170	7.6	
Combustion:	1	0.25	460	1	3200	0.9	

Unit Rating

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

Cabinet Sound Power Levels*

Octave Bands:	63	125	250	500	1000	2000	4000	8000
Discharge LW (dB):	83	83	85	83	80	82	78	74
Return LW (dB):	71	69	66	61	63	61	57	50

*Sound data is generated by a proprietary acoustics model validated through unit testing in accordance with AHRI 260, utilizing tested fan sound data in accordance with AMCA 300.

***The minimum floor area for the Lower Flammability Limit (LFL) is calculated in accordance with UL60335-2-40 4th ed. (operating or storage). For UL60335-2-40 3rd ed. double the airflow and minimum floor area listed.*

27.4" STAR Plenum

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

JOB INFORMATION:

Job Name:	*Swonder Phase 3 - 2025*
Job Tag:	*RTU #8*
Date:	*6/4/2025 12:00:00 AM*

OPERATING CONDITIONS

Air Flow:	*4000*
Fan Energy Index (FEI):	*1.43*
Static Pressure:	*1.96 in. Wg*
Relief Dampers DP:	*0 in. Wg*
TSP:	*1.99 in. Wg*
Site Altitude	*386 ft*
TSP @ Sea Level:	*1.99 in. Wg*

FAN PERFORMANCE:

RPM:	*1005*
BHP:	*1.83*
Efficiency:	*67.54%*
Max Duct SP with Blocked Airway:	*0 in. Wg @1005 RPM*

Max Duct SP with Blocked Airway:

WHEEL SPECIFICATION:

Max RPM:	*1800*
Diameter x Qty:	*27.4 in. x 1*
CFM:	*4000*
Inertia:	*16WR²*

MOTOR SELECTION

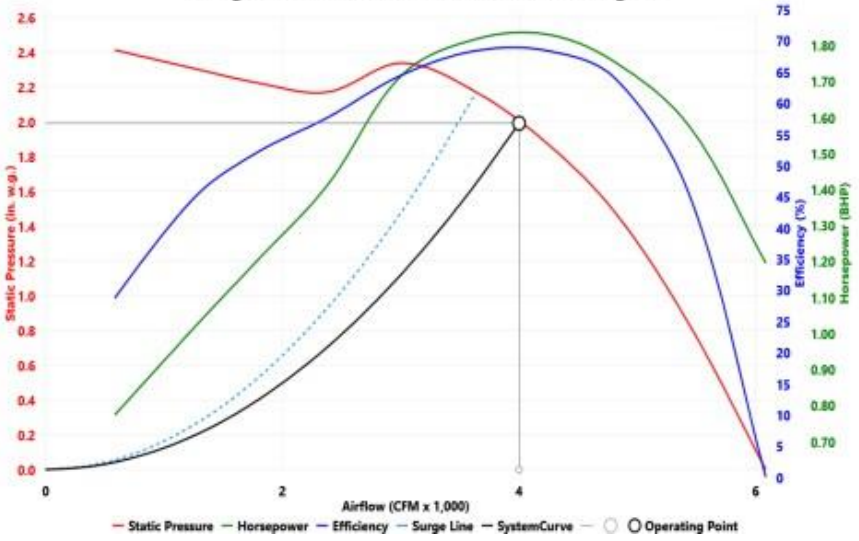
Rated HP / Bypass:	*5 x 1 / No*
Frame Size:	*215T*
Nominal RPM:	*1170*
VAC/PH/HZ:	*460V/3Ø/60Hz*
Enclosure Type:	*ODP*
Max Inertial Load:	*0 WR²*

FAN SOUND POWER (Inlet/Outlet)

Octave Band:				(Re 10^-12 watts)			
1	2	3	4	5	6	7	8
81	78	77	76	77	77	76	75
83	83	85	84	82	84	81	77

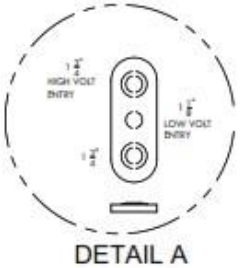
SOUND POWER A-Weighted: 89 dB

Supply Fan Model: 270D60 @ 1005 RPM and 100% Width
Design Conditions: 4000 CFM @ 1.99 in. w.g. SP



RN SERIES
C - CABINET WITH ECONOMIZER ~ 16-30 TON

CLEARANCES	
LOCATION	• UNIT SIZE • 16 - 30 TON
OUTSIDE AIR (BACK)	48
CONTROLS SIDE (FRONT)	48
LEFT SIDE	6
RIGHT SIDE	60
TOP	UNOBSTRUCTED



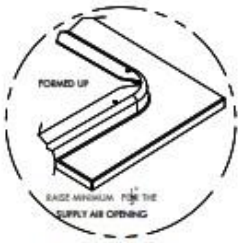
DETAIL A

DETAIL B

NUMBER OF CONDENSER FANS

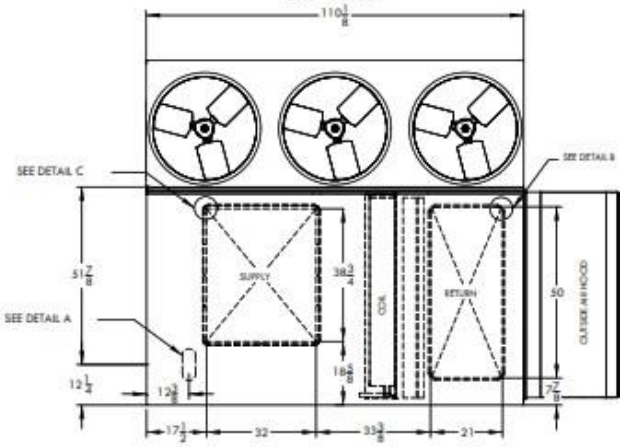
16,18 & 20 TON - 2 FANS

25 & 30 TON - 3 FANS

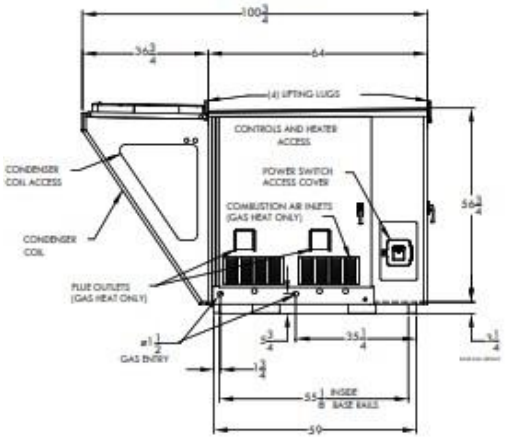


DETAIL C

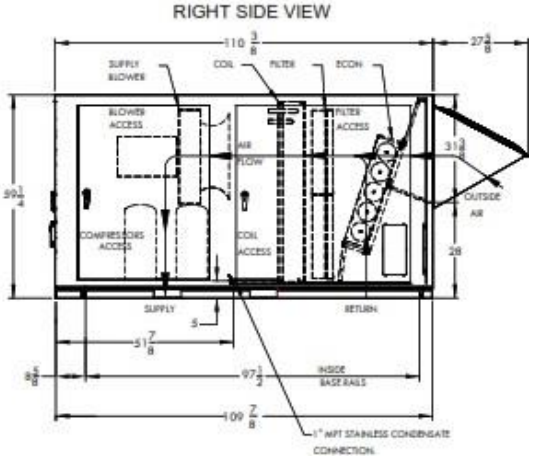
TOP VIEW



FRONT VIEW



RIGHT SIDE VIEW



RNC-00002 REVJE 12/27/22 JWC

FIELD GAS PIPING DETAILS

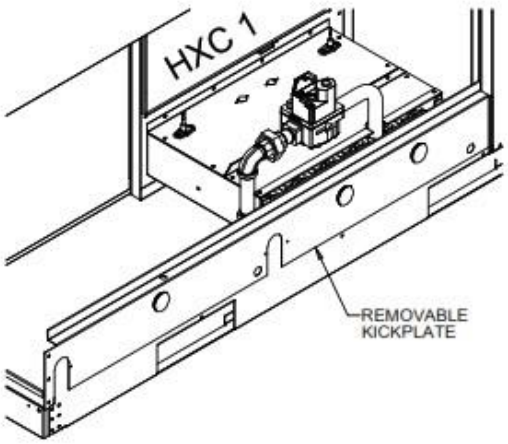
RN SERIES C - CABINET
16-30 TON

270 MBH
2 STAGE, MODULATING

CAT000427 RNC REV A 04/25/23 JAS
ALL DIMENSIONS ARE IN INCHES

Field gas piping is required to the internal gas valves.
Piping should be installed adhering to building codes.
Perform leak check prior to operation.

Reference IOM for additonal information,
and details on optional gas entry through base.

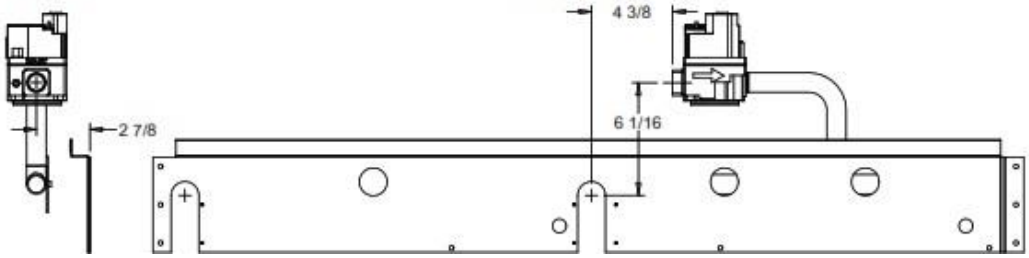


HEAT EXCHANGER 1

TOP

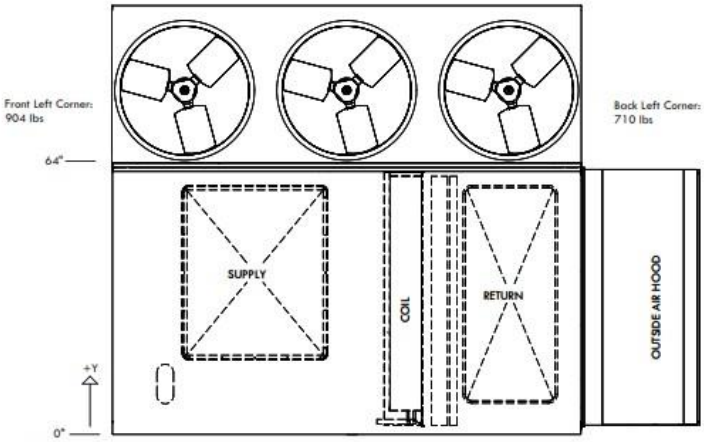
SIDE

FRONT



RNC CABINET
AIR COOLED CONDENSING UNIT

RNA-016-C-A-3-GAB0C-CB1K0:00-0FG0H-E00-00000-00000-DC-000J-00-E0-C-AN0-EB-EA0A-00-000-BA0A00-E000AF-000000B



Disclaimer:
This weight estimate does not account for any SPAs.

RTU-9 (RNA-013)

Unit Rating

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

RNA-013-B-A-3-GAB0B-CB3L0:00-0ACAG-E00-00000-00000-DC-000
J-00-E0-C-AN0-EB-BA0A-00-000-BA0A00-E000AF-000000B

Tag: RTU #9

Job Information

Job Name:	*Swonder Phase 3 - 2025*
Job Number:	*AC2533687*
Site Altitude:	*386 ft*
Refrigerant:	*R-454B*
Design System Charge (oz):	*220 / 378*

Static Pressure

External:	*1.10 in. w.g.*
Cooling Coil:	*0.29 in. w.g.*
Filters Clean:	*0.12 in. w.g.*
Dirt Allowance:	*0.35 in. w.g.*
Reheat Coil:	*0.05 in. w.g.*

Cooling Section

	Gross	Net
Total Capacity:	*162.0 MBH*	*153.6 MBH*
Sensible Capacity:	*123.8 MBH*	*115.4 MBH*
Latent Capacity:	*38.2 MBH*	
Mixed Air Temp (DB/WB):	*79.7 °F / 65.4 °F*	
Entering Air Temp (DB/WB):	*79.7 °F / 65.4 °F*	
Lv Air Temp (Coil) (DB/WB):	*52.4 °F / 52.2 °F*	
Lv Air Temp (Unit) (DB/WB):	*54.1 °F / 52.9 °F*	

Supply Air Fan:	*1 x RN185 @ 2.97 BHP Ea.*
SA Fan RPM / Width:	*2069 RPM / 4.140 in*
SA Fan FEI:	*1.11*
Evaporator Coil:	*14.6 ft² / 6 Rows / 12 FPI*
Evaporator Face Velocity:	*294.9 fpm*

Unit Information

Approx. Op./Ship Weights:	*2187 lbs / 2187 lbs (±5%)*
Ambient Temperature (DB/WB):	*95.0 °F / 75.0 °F*
Coil Filter FV / Qty:	*309.6 fpm / 4*
Min. Room Area/Height/Airflow**:	*355 ft² / 7 ft / 640 SCFM*
Outside Air Prefilter FV / Qty:	*294.2 fpm / 1*
Supply Airflow/ESP:	*4300 SCFM / 1.10 in. w.g.*
Outside Airflow:	*1000 SCFM*
Return Temperature (DB/WB):	*75.0 °F / 62.0 °F*
Economizer:	*0.24 in. w.g.*
Heating:	*0.11 in. w.g.*
Cabinet:	*0.16 in. w.g.*
Total:	*2.41 in. w.g.*

Heating Section

Preheat Type:	*Std (No Preheat)*
Auxiliary Heating Type:	*Nat. Gas Heat*
Heating Airflow:	*4300 SCFM*
Total Capacity:	*315.9 MBH*
Entering Air Temp (DB/WB):	*57.6 °F / 52.0 °F*
Leaving Air Temp (DB/WB):	*125.6 °F / 74.7 °F*
Consumption:	*390.0 MBH*
Total Turndown Ratio:	*10.0:1*

Re-heat Coil:

Capacity:	*88.9 MBH*
Leaving Air Temp (DB/WB):	*72.0 °F / 59.9 °F*
Relative Humidity:	*49.4%*

Rating Information

Listing Model	*RN-013-3-0-GABY-V0-21-000-A*
Cooling Capacity:	*148.0 MBH*
Cooling EER:	*11.86 BTU/h-W*
Cooling IEER:	*16.27 BTU/h-W*

**Rated in accordance with AHRI Standard 340/360 (I-P)*

Application EER @ Op. Conditions: ***10.5 BTU/h-W***

Electrical Data

Circuit 1

Rating:	*460V/3Ø/60Hz*	*Minimum Circuit Amp:*	*33*
Unit FLA:	*30*	*Maximum Overcurrent:*	*40*
SCCR:	*10 KAIC*		

	Qty	HP	VAC	Phase	RPM	FLA	RLA
Compressor 1:	*2*		*460*	*3*			*10.9*
Condenser Fan:	*2*	*0.75*	*460*	*3*	*1080*	*1.8*	
Supply Fan:	*1*	*3.00*	*460*	*3*	*1760*	*4.8*	
Combustion:	*1*	*0.09*	*460*	*1*	*3000*	*0.7*	

Unit Rating

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 356

Cabinet Sound Power Levels*

Octave Bands:	63	125	250	500	1000	2000	4000	8000
Discharge LW (dB):	89	88	91	88	81	77	75	70
Return LW (dB):	80	77	78	73	68	64	59	49

*Sound data is generated by a proprietary acoustics model validated through unit testing in accordance with AHRI 260, utilizing tested fan sound data in accordance with AMCA 300.

***The minimum floor area for the Lower Flammability Limit (LFL) is calculated in accordance with UL60335-2-40 4th ed. (operating or storage). For UL60335-2-40 3rd ed. double the airflow and minimum floor area listed.*

18.5" STAR Plenum

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 356

JOB INFORMATION:

Job Name:	*Swonder Phase 3 - 2025*
Job Tag:	*RTU #9*
Date:	*6/4/2025 12:00:00 AM*

OPERATING CONDITIONS

Air Flow:	*4300*
Fan Energy Index (FEI):	*1.11*
Static Pressure:	*2.41 in. Wg*
Relief Dampers DP:	*0 in. Wg*
TSP:	*2.44 in. Wg*
Site Altitude	*386 ft*
TSP @ Sea Level:	*2.44 in. Wg*

FAN PERFORMANCE:

RPM:	*2069*
BHP:	*2.97*
Efficiency:	*55.01%*
Max Duct SP with Blocked Airway:	*0 in. Wg @2069 RPM*

Max Duct SP with Blocked Airway:

WHEEL SPECIFICATION:

Max RPM:	*3000*
Diameter x Qty:	*18.5 in. x 1*
CFM:	*4300*
Inertia:	*3WR²*

MOTOR SELECTION

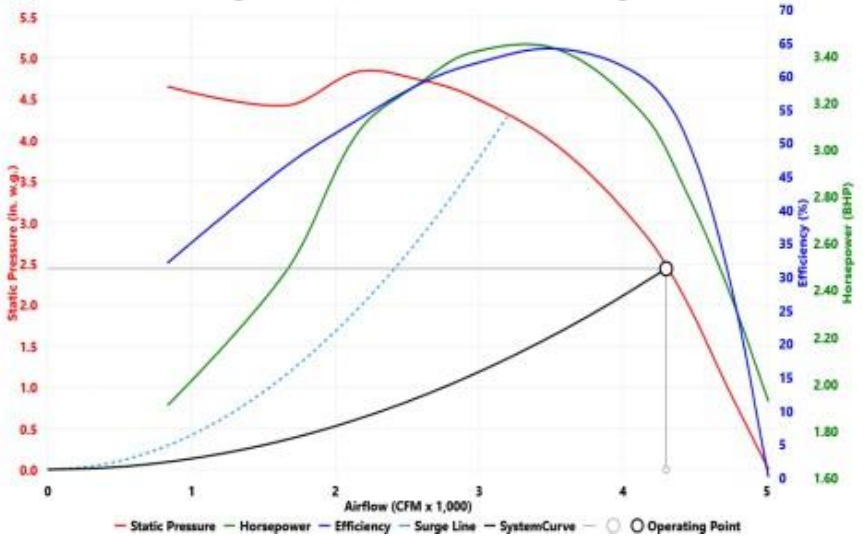
Rated HP / Bypass:	*3 x 1 / No*
Frame Size:	*182T*
Nominal RPM:	*1760*
VAC/PH/HZ:	*460V/3Ø/60Hz*
Enclosure Type:	*ODP*
Max Inertial Load:	*0 WR²*

FAN SOUND POWER (Inlet/Outlet)

Octave Band:					(Re 10^-12 watts)			
1	2	3	4	5	6	7	8
89	88	91	90	84	81	79	74
89	88	91	90	84	81	79	74

SOUND POWER A-Weighted: 91 dB

Supply Fan Model: RN185 @ 2069 RPM and 100% Width
Design Conditions: 4300 CFM @ 2.44 in. w.g. SP



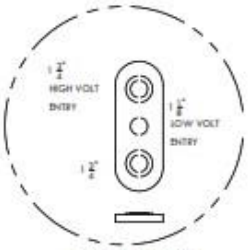
RN SERIES
B - CABINET WITH ECONOMIZER ~ 9-15 TON

CLEARANCES	
LOCATION	• UNIT SIZE • 9 - 15 TON
OUTSIDE AIR (BACK)	48
CONTROLS SIDE (FRONT)	48
LEFT SIDE	6
RIGHT SIDE	48
TOP	UNOBSTRUCTED

NUMBER OF CONDENSER FANS

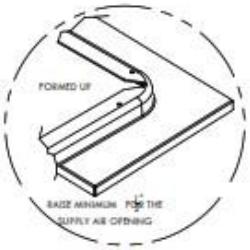
9 & 11 TON - 1 FAN

13 & 15 TON - 2 FANS



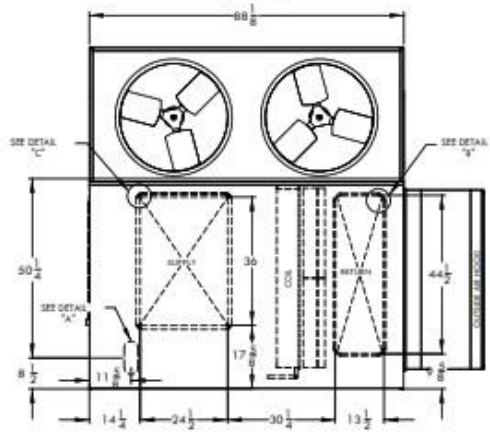
DETAIL A

DETAIL B

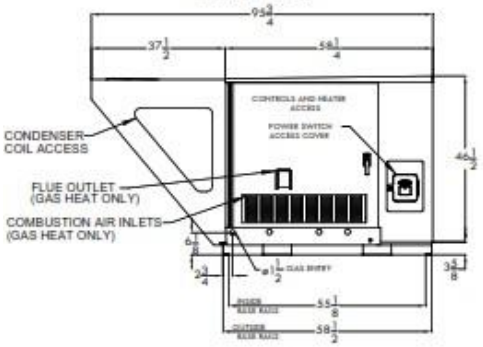


DETAIL C

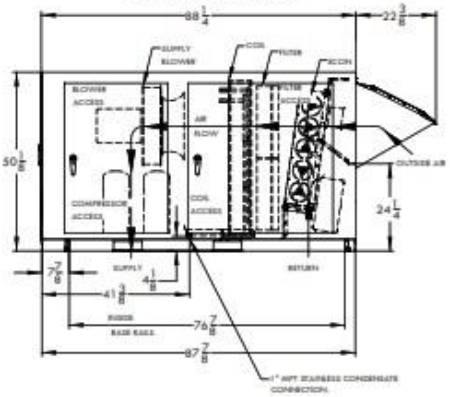
TOP VIEW



FRONT VIEW



RIGHT SIDE VIEW



RNB-00002 REVD 02/22/23 JWC
NOTE: ALL DIMENSIONS ARE IN INCHES

FIELD GAS PIPING DETAILS

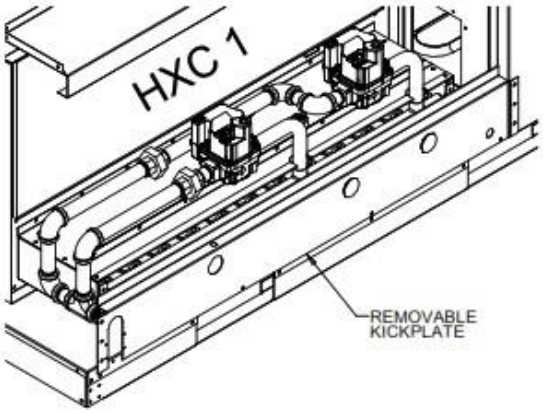
RN SERIES B - CABINET
9-15 TON

195/292.5/390 MBH
4 STAGE, HIGH TURNDOWN

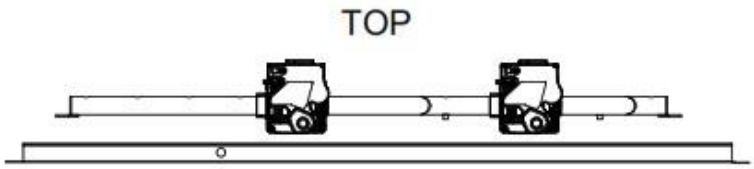
CAT000426 RNB REV A 04/25/23 JAS
ALL DIMENSIONS ARE IN INCHES

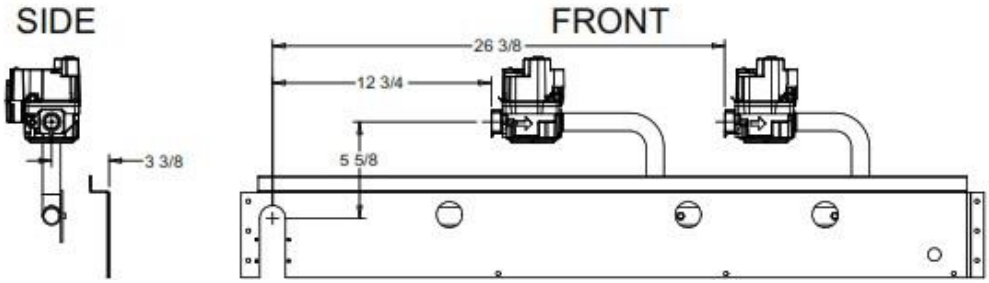
Field gas piping is required to the internal gas valves.
Piping should be installed adhering to building codes.
Perform leak check prior to operation.

Reference IOM for additonal information,
and details on optional gas entry through base.



HEAT EXCHANGER 1

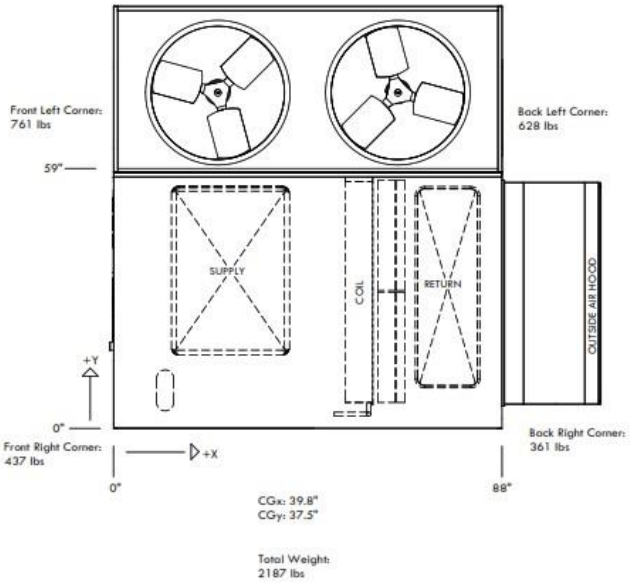




RNB CABINET
AIR COOLED CONDENSING UNIT

AAON

RNA-013-B-A-3-GAB0B-CB3L0:00-0ACAG-E00-00000-00000-DC-000J-00-E0-C-AN0-EB-BA0A-00-000-BA0A00-E000AF-000000B



Disclaimer:
This weight estimate does not account for any SPAs.

RTU-10 (RNA-020)

AAON

Unit Rating

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 356

A1 A2 A3 A4 A5 B1 B2 B3 B4 B5 1 2 3A 3B 3C 3D 3E 4A 4B 4C 5A 5B 5C 5D 5E 6A 6B 6C 6D 6E 7 8 9A 9B 9C

RNA-020-C-A-3-GAB0C-CB2K0:00-0FG0H-E00-00000-00000-DC-000
J-00-E0-C-AN0-EB-EA0A-00-000-BA0A00-E000AF-000000B

9D 10A 10B 11A 11B 12 13A 13B 13C 14 15 16A 16B 16C 16D 17A 17B 18A 18B 18C 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37

Tag: RTU #10

Job Information

Job Name:	*Swonder Phase 3 - 2025*
Job Number:	*AC2533687*
Site Altitude:	*386 ft*
Refrigerant:	*R-454B*
Design System Charge (oz):	*273 / 458*

Unit Information

Approx. Op./Ship Weights:	*2996 lbs / 2996 lbs (±5%)*
Ambient Temperature (DB/WB):	*95.0 °F / 75.0 °F*
Coil Filter FV / Qty:	*314.4 fpm / 6*
Min. Room Area/Height/Airflow**:	*430 ft² / 7 ft / 775 SCFM*
Outside Air Prefilter FV / Qty:	*139.5 fpm / 4*
Supply Airflow/ESP:	*6550 SCFM / 1.10 in. w.g.*
Outside Airflow:	*1550 SCFM*
Return Temperature (DB/WB):	*75.0 °F / 62.0 °F*

Static Pressure

External:	*1.10 in. w.g.*	Economizer:	*0.14 in. w.g.*
Cooling Coil:	*0.36 in. w.g.*	Heating:	*0.22 in. w.g.*
Filters Clean:	*0.12 in. w.g.*	Cabinet:	*0.13 in. w.g.*
Dirt Allowance:	*0.35 in. w.g.*	Total:	*2.48 in. w.g.*
Reheat Coil:	*0.06 in. w.g.*		

Cooling Section

	Gross	Net
Total Capacity:	*250.3 MBH*	*238.4 MBH*
Sensible Capacity:	*189.8 MBH*	*178.0 MBH*
Latent Capacity:	*60.4 MBH*	
Mixed Air Temp (DB/WB):	*79.7 °F / 65.4 °F*	
Entering Air Temp (DB/WB):	*79.7 °F / 65.4 °F*	
Lv Air Temp (Coil) (DB/WB):	*52.3 °F / 52.0 °F*	
Lv Air Temp (Unit) (DB/WB):	*53.9 °F / 52.7 °F*	
Supply Air Fan:	*1 x 270D60 @ 4.17 BHP Ea.*	
SA Fan RPM / Width:	*1347 RPM / 3.680 in*	
SA Fan FEI:	*1.19*	
Evaporator Coil:	*19.9 ft² / 6 Rows / 12 FPI*	
Evaporator Face Velocity:	*329.8 fpm*	

Heating Section

Preheat Type:	*Std (No Preheat)*
Auxiliary Heating Type:	*Nat. Gas Heat*
Heating Airflow:	*6550 SCFM*
Total Capacity:	*328.1 MBH*
Entering Air Temp (DB/WB):	*57.3 °F / 51.8 °F*
Leaving Air Temp (DB/WB):	*103.7 °F / 68.5 °F*
Consumption:	*405.0 MBH*
Total Turndown Ratio:	*4.3:1*

Re-heat Coil:

Capacity:	*136.1 MBH*
Leaving Air Temp (DB/WB):	*72.0 °F / 59.8 °F*
Relative Humidity:	*49.1%*

Rating Information

Listing Model	*RN-020-3-0-GABY-V0-21-000-A*
Cooling Capacity:	*235.0 MBH*
Cooling EER:	*11.86 BTU/h·W*
Cooling IEER:	*15.19 BTU/h·W*

**Rated in accordance with AHRI Standard 340/360 (I-P)*

Application EER @ Op. Conditions: ***10.6 BTU/h·W***

Electrical Data

Circuit 1

Rating:	*460V/3Ø/60Hz*	*Minimum Circuit Amp:*	*45*
Unit FLA:	*41*	*Maximum Overcurrent:*	*60*
SCCR:	*10 KAIC*		

	Qty	HP	VAC	Phase	RPM	FLA	RLA
Compressor 1:	1		460	3	3500		16.0
Compressor 2:	1		460	3			14.0
Condenser Fan:	2	0.75	460	3	1080	1.8	
Supply Fan:	1	5.00	460	3	1170	7.6	
Combustion:	2	0.25	460	1	3200	0.9	

Unit Rating

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

Cabinet Sound Power Levels*

Octave Bands:	63	125	250	500	1000	2000	4000	8000
Discharge LW (dB):	90	89	90	91	88	87	86	82
Return LW (dB):	78	77	74	67	68	67	64	57

*Sound data is generated by a proprietary acoustics model validated through unit testing in accordance with AHRI 260, utilizing tested fan sound data in accordance with AMCA 300.

***The minimum floor area for the Lower Flammability Limit (LFL) is calculated in accordance with UL60335-2-40 4th ed. (operating or storage). For UL60335-2-40 3rd ed. double the airflow and minimum floor area listed.*

27.4" STAR Plenum

2425 South Yukon Ave • Tulsa, OK 74107 • Ph: (918) 583-2266
Ecat Price Version: 358

JOB INFORMATION:

Job Name:	*Swonder Phase 3 - 2025*
Job Tag:	*RTU #10*
Date:	*6/4/2025 12:00:00 AM*

WHEEL SPECIFICATION:

Max RPM:	*1800*
Diameter x Qty:	*27.4 in. x 1*
CFM:	*6550*
Inertia:	*16WR²*

OPERATING CONDITIONS

Air Flow:	*6550*
Fan Energy Index (FEI):	*1.19*
Static Pressure:	*2.48 in. Wg*
Relief Dampers DP:	*0 in. Wg*
TSP:	*2.52 in. Wg*
Site Altitude	*386 ft*
TSP @ Sea Level:	*2.52 in. Wg*

MOTOR SELECTION

Rated HP / Bypass:	*5 x 1 / No*
Frame Size:	*215T*
Nominal RPM:	*1170*
VAC/PH/HZ:	*460V/3Ø/60Hz*
Enclosure Type:	*ODP*
Max Inertial Load:	*0 WR²*

FAN PERFORMANCE:

RPM:	*1347*
BHP:	*4.17*
Efficiency:	*61.41%*
Max Duct SP with Blocked Airway:	*0 in. Wg @1347 RPM*

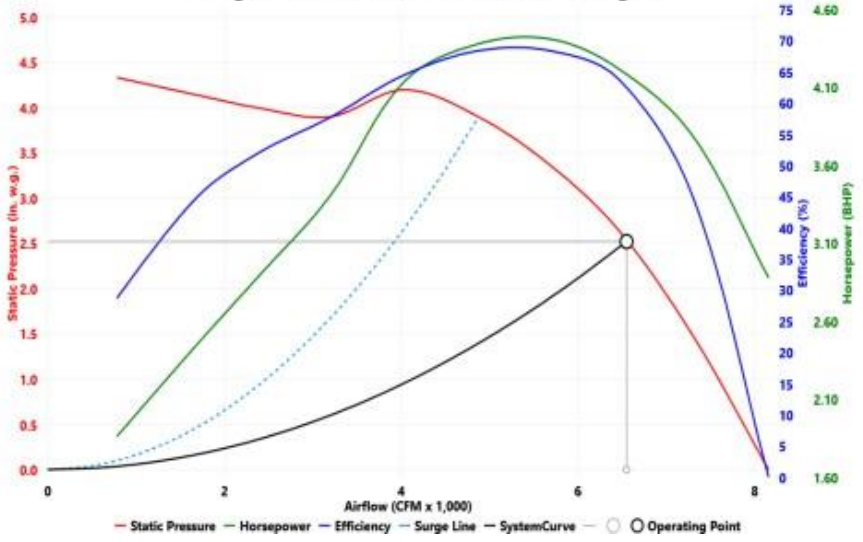
Max Duct SP with Blocked Airway:

FAN SOUND POWER (Inlet/Outlet)

Octave Band:	1	2	3	4	5	6	7	8
(Re 10^-12 watts)	88	86	84	82	82	83	83	82
	90	89	90	92	90	89	89	85

SOUND POWER A-Weighted: 96 dB

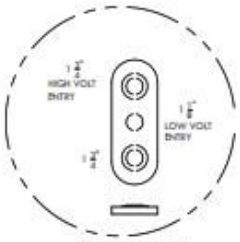
Supply Fan Model: 270D60 @ 1347 RPM and 100% Width
Design Conditions: 6550 CFM @ 2.52 in. w.g. SP



RN SERIES
C - CABINET WITH ECONOMIZER ~ 16-30 TON

CLEARANCES

LOCATION	• UNIT SIZE • 16 - 30 TON
OUTSIDE AIR (BACK)	48
CONTROLS SIDE (FRONT)	48
LEFT SIDE	6
RIGHT SIDE	60
TOP	UNOBSTRUCTED



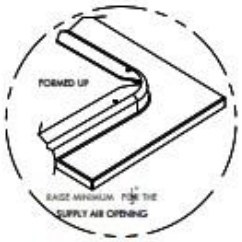
DETAIL A

DETAIL B

NUMBER OF CONDENSER FANS

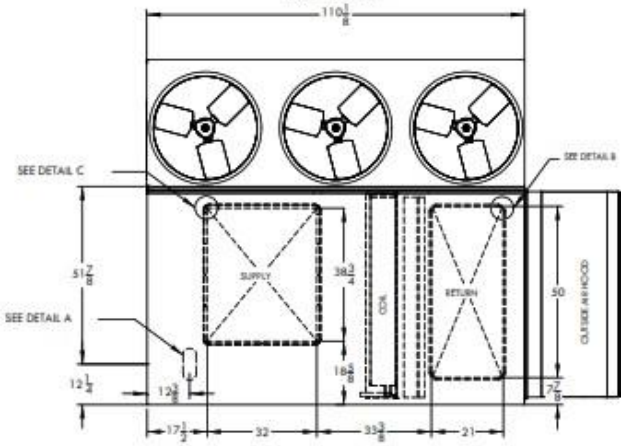
16,18 & 20 TON - 2 FANS

25 & 30 TON - 3 FANS

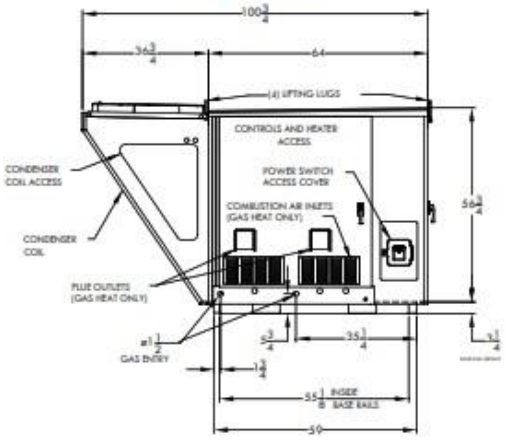


DETAIL C

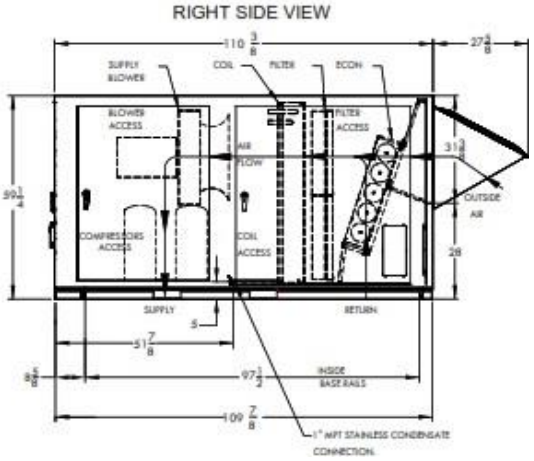
TOP VIEW



FRONT VIEW



RIGHT SIDE VIEW



RNC-00002 REVE 12/27/22 JWC

FIELD GAS PIPING DETAILS

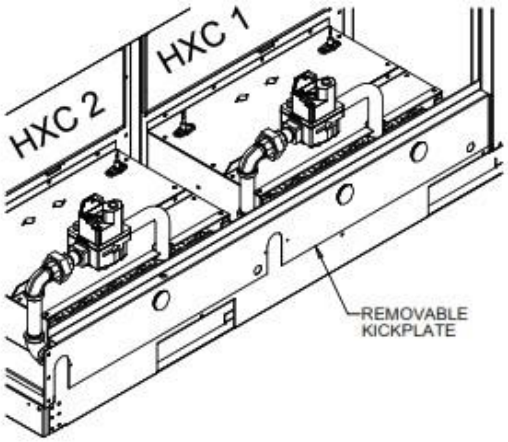
RN SERIES C - CABINET
16-30 TON

405/540 MBH
2-4 STAGE, MODULATING

CAT000429 RNC REV A 04/25/23 JAS
ALL DIMENSIONS ARE IN INCHES

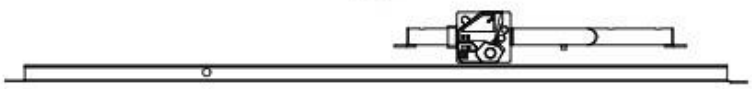
Field gas piping is required to the internal gas valves.
Piping should be installed adhering to building codes.
Perform leak check prior to operation.

Reference IOM for additonal information,
and details on optional gas entry through base.

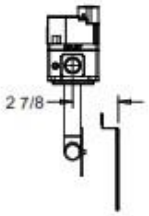


HEAT EXCHANGER 1

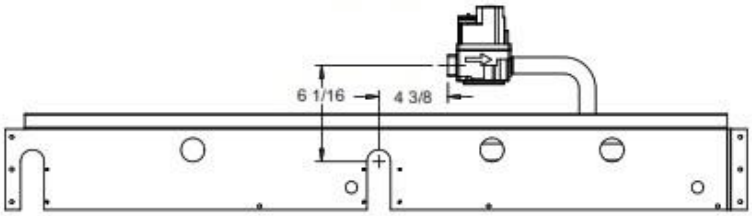
TOP



SIDE

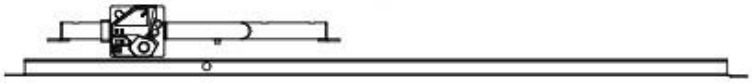


FRONT

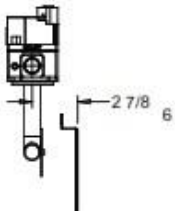


HEAT EXCHANGER 2

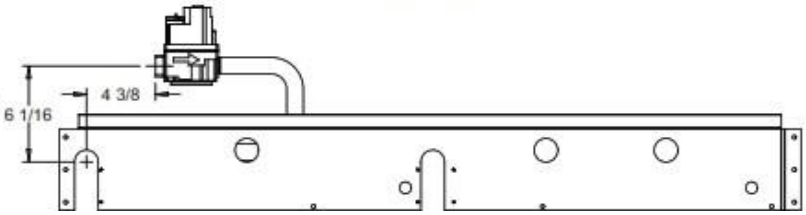
TOP



SIDE

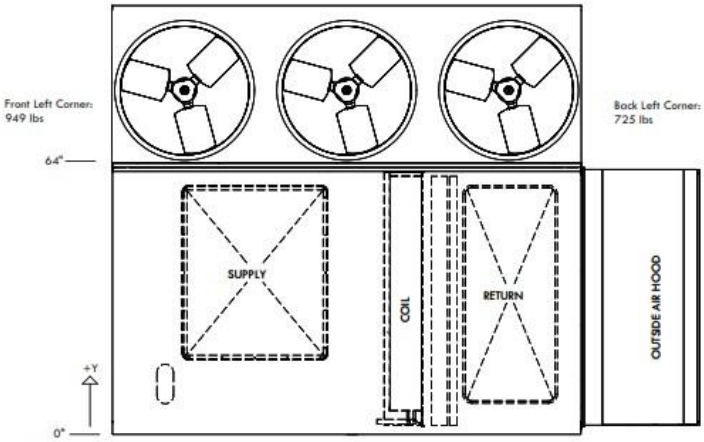


FRONT



RNC CABINET
AIR COOLED CONDENSING UNIT

RNA-020-C-A-3-GAB0C-CB2K0:00-0FG0H-E00-00000-00000-DC-000J-00-E0-C-AN0-EB-EA0A-00-000-BA0A00-E000AF-000000B



Disclaimer:
This weight estimate does not account for any SPAs.

4.0 Existing Rooftop Unit Performance Specifications

RTU-5 (Des Champs MWT-100)

Des Champs Laboratories, Inc.
MOACS Unit Performance

Box 220, Natural Bridge Station, VA 24579
Phone: (540) 291-1111 Fax: (540) 291-2211

9/28/01 1:32:06 PM Ver. 2.3.36
Marketing@Entrodyne.com

Order Name	Swonder Ice Arena	Location	IN
Order Number	34835 -- SON: 43998	Prepared By	DLW
(Qty) Model	(1) PV-W10-MWT100	Unit Tag	RTU-5
Representative	IAP/A.C. Systems	Engineering Firm	-
Altitude	0		

UNIT SELECTION DETAILS:

Unit Size	PV-W10-MWT100-7
Condenser MBH - Evaporator Coil Rows	360-4
Heating Options Chosen	800MBH Input (Nat. Gas Only)
Total Supply Air Flow, SCFM	10,000
Amount bypassed for Sensible Control, SCFM	0
Total Return Air Flow, SCFM	9,500

COOLING PERFORMANCE:

Unit Cooling Capacity, Total MBH (T1-T3)	1,055.5
Unit Cooling Capacity, Sensible/Latent MBH(T1-T3)	481.5/574.0
Coil Cooling Capacity, Total MBH (T2-T3)	323.0
Precool by Exchanger, Total MBH (T1-T2)	803.7
Compressor Power Consumption, KW	23.7
Moisture Removed by Unit, LBS/Hour	561.8

SUMMER TEMPERATURES:

Summer Outside Air Design, F (DB/WB)	(T1) 90.0/79.0
Entering Coil, F (DB/WB)	(T2) 59.7/58.0
Leaving Coil, F (DB)	(T3) 45.4
Supply, F (DB/WB)	(T4) 50.9/48.0
Summer Return Air Design, F (DB/%RH)	(T6) 55.0/70.0
Exhaust Outlet, F (DB/RH)	(T8) 83.4/65

HEATING PERFORMANCE: (Frost Protected)

Unit Heating Capacity, Total MBH (T1-T5)	771.8

WINTER TEMPERATURES:

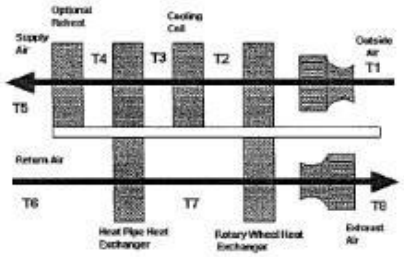
Winter Outside Air Design, F (DB/WB)	(T1)4.0/4.0
Aux. Heat Entering, F (DB)	(T4) 12.5
Leaving Air, F (DB/WB)	(T5) 71.8/48.1
Winter Return Air Design, F (DB/%RH)	(T6) 45.0/80.0
Exhaust Outlet, F (DB/RH)	(T8) 36.0/94

Des Champs Laboratories, Inc.
MOACS Unit Performance

Box 220, Natural Bridge Station, VA 24579
Phone: (540) 291-1111 Fax: (540) 291-2211

9/28/01 1:32:06 PM Ver. 2.3.36
Marketing@Entrodyne.com

Order Name	Swonder Ice Arena	Location	IN
Order Number	34835 — SON: 43998	Prepared By	DLW
(Qty) Model	(1) PV-W10-MWT100	Unit Tag	RTU-5
Representative	IAP/A.C. Systems	Engineering Firm	-
Altitude	0		



Des Champs Laboratories, Inc.
MOACS Selection Details

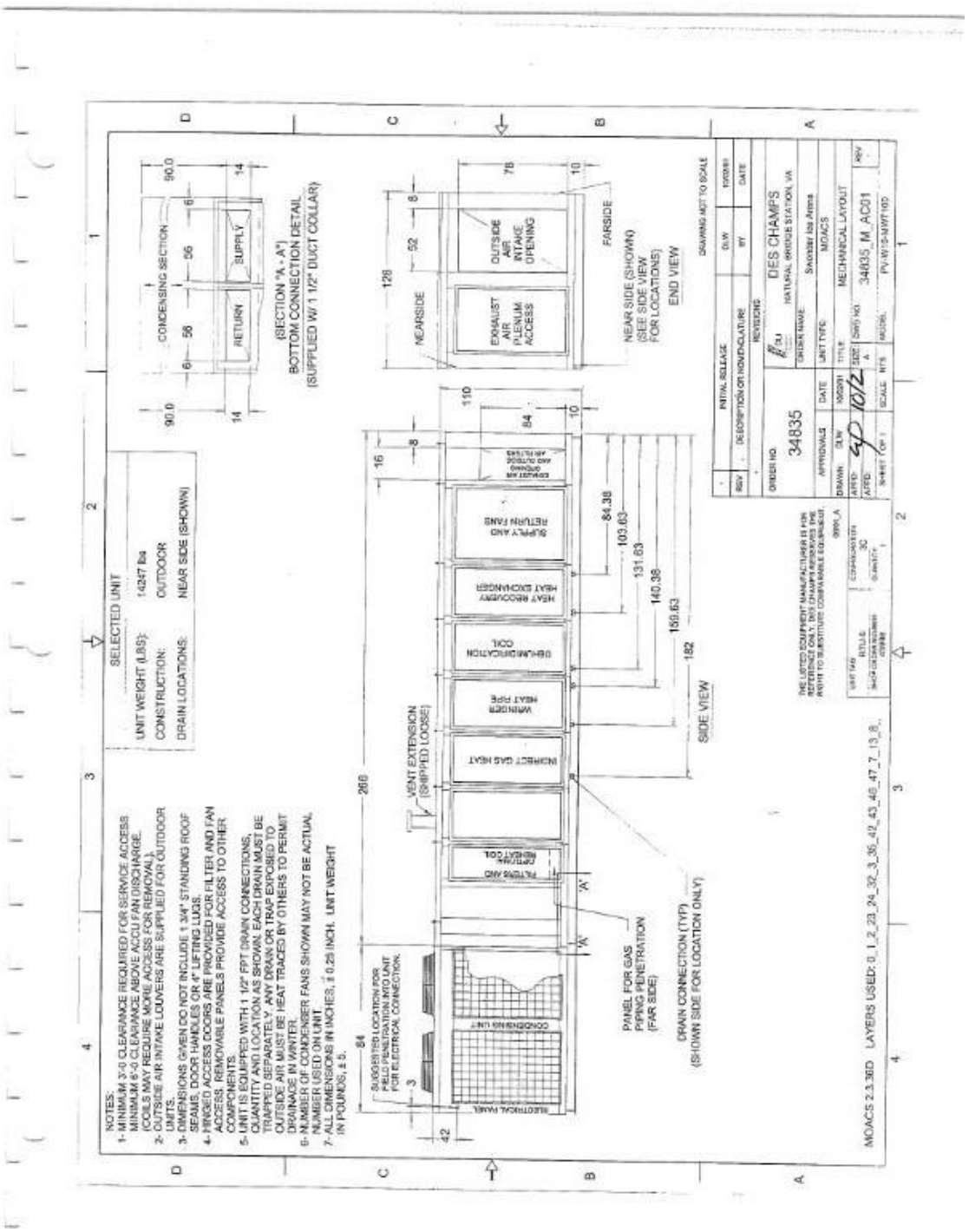
Box 220, Natural Bridge Station, VA 24579
Phone: (540) 291-1111 Fax: (540) 291-2211

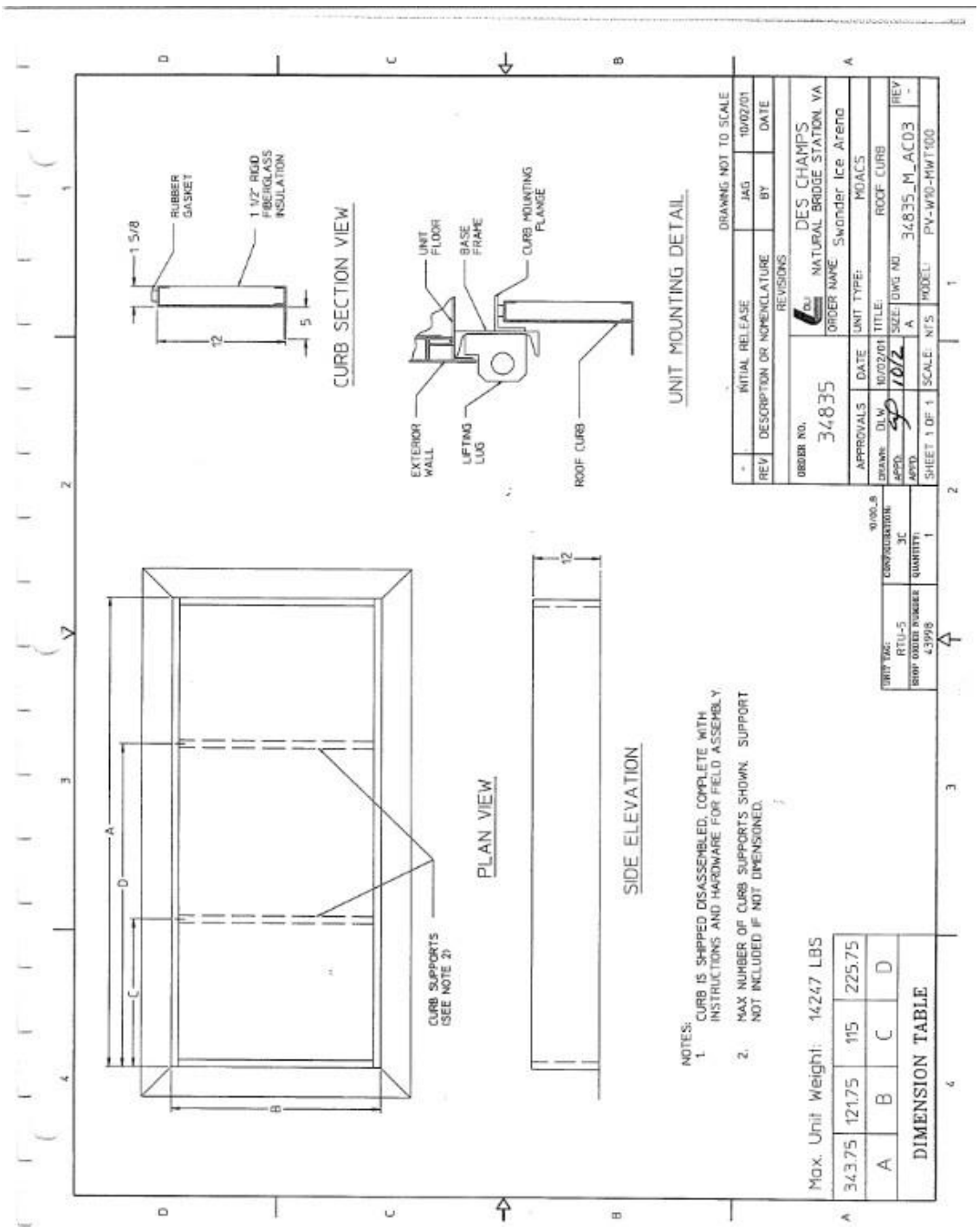
9/28/01 1:32:06 PM Ver. 2.3.36
Marketing@Entrodyne.com

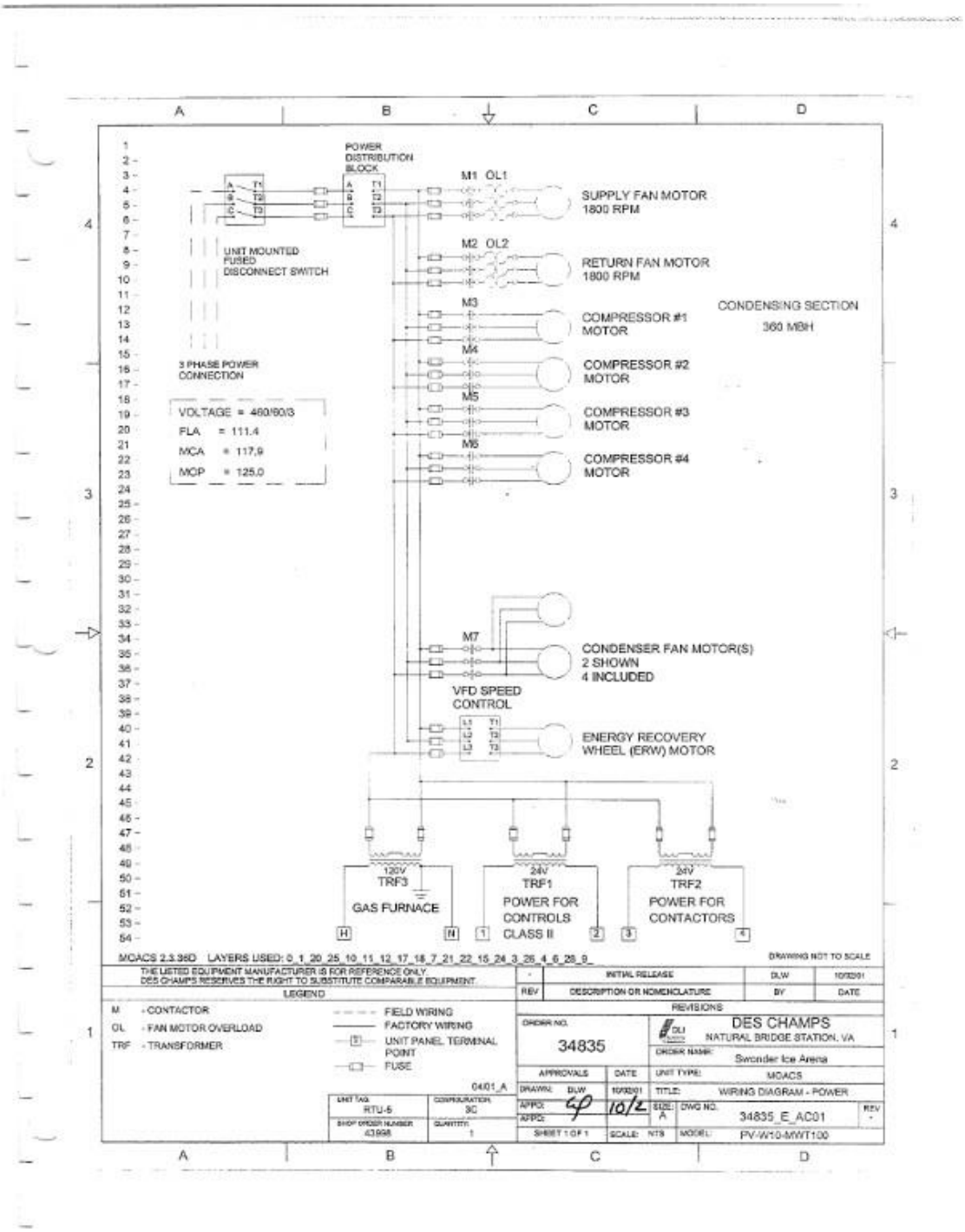
Order Name	Swonder Ice Arena	Location	IN
Order Number	34835 -- SON: 43998	Prepared By	DLW
(Qty) Model	(1) PV-W10-MWT100	Unit Tag	RTU-5
Representative	IAP/A.C. Systems	Engineering Firm	-
Altitude	0		

MODEL NUMBER: PV-W10-MWT100 CONFIGURATION: 3C

SELECTED UNIT DESCRIPTION:
PV-W10-MWT100 with 7 row heat pipe, 10000 SCFM Supply
and 9500 SCFM Return
COOLING: Direct Expansion (Integral Air Cooled Condenser)
»360 MBH nominal COOLING CAPACITY with a 4 ROW COIL
REHEAT: 800MBH Input (Nat. Gas Only) Indirect Gas Reheat
SUPPLY FAN: 24 in. diam. with 20 HP ODP High Eff. motor
»At 2108 RPM and 15. BHP (@ 1 in. ESP, 4.42 in. TSP)
»990 CFM allowed for rotary exchanger seal leakage
OUTSIDE AIR DAMPER: ~~2 position~~ low leak modulating
FACE & BYPASS DAMPERS: Modulating low leak
RECIRCULATION ~~2 position~~ low leak damper modulating
EXHAUST AIR DAMPER: ~~2 position~~ low leak modulating
JRN FAN:22 in. diam. with 15 HP ODP High Eff. MOTOR
»At 2357 RPM and 12. BHP (@ 1 in. ESP, 3.47 in. TSP)
»990 CFM allowed for rotary exchanger seal leakage
SUPPLY FILTERS: 2 Inch 30% Pleated
RETURN FILTERS: 2 Inch 30% Pleated
»All Filters Include an Anti-Microbial Coating
ELECTRICAL: 460/60/3
»111.4 Full Load Amps and 117.9 Minimum Circuit Ampacity
»125.0 Max Overcurrent Protection
»Unit Mounted DISCONNECT option
CONTROLS:Lvg.Air T--SpaceHum.--SpaceT--SupplyDewPt.
Summer:_ - MIN.&MAX. --MAX.-- MIN.&MAX. -- MAX.
Winter:_D - MIN.&MAX. --NONE-- MIN.&MAX. -- NONE
»ETL listed
INSTALLATION: Outdoor, with Curb and with Louver (Selkirk curb)
»SUPPLY AIR OUTLET: Bottom
»RETURN AIR INLET: Bottom
»DRAIN CONNECTION: Near side (Exhaust Air Outlet Side)
»FROST PROTECTION: VFD on Wheel & Bypass on Heat Pipe
»1 yr warranty
»Total Unit Weight: 14247 lbs


SELECTED UNIT
UNIT WEIGHT (LBS): 14247 lbs
CONSTRUCTION: OUTDOOR
DRAIN LOCATIONS: NEAR SIDE (SHOWN)
CONDENSING SECTION
RETURN
SUPPLY
(SECTION "A - A")
BOTTOM CONNECTION DETAIL
(SUPPLIED W/ 1 1/2" DUCT COLLAR)
NEARSIDE
FARSIDE
EXHAUST AIR PLENUM ACCESS
OUTSIDE AIR INTAKE OPENING
NEAR SIDE (SHOWN)
(SEE SIDE VIEW FOR LOCATIONS)
END VIEW
SUPPLY AND RETURN FANS
HEAT RECOVERY HEAT EXCHANGER
DEHUMIDIFICATION COIL
MINDER HEAT PIPE
INDIRECT GAS HEAT
FILTERS AND OPTIONAL HEAT COIL
ELECTRICAL PANEL
CONDENSING UNIT
VENT EXTENSION (SHIPPED LOOSE)
SUGGESTED LOCATION FOR FIELD PENETRATION INTO UNIT FOR ELECTRICAL CONNECTION.
PANEL FOR GAS PIPING PENETRATION (FAR SIDE)
DRAIN CONNECTION (TYP) (SHOWN SIDE FOR LOCATION ONLY)
SIDE VIEW
DRAWING NOT TO SCALE
NOTES:
1- MINIMUM 3'-0 CLEARANCE REQUIRED FOR SERVICE ACCESS. MINIMUM 4'-0 CLEARANCE ABOVE ACCU FAN DISCHARGE. (COILS MAY REQUIRE MORE ACCESS FOR REMOVAL).
2- OUTSIDE AIR INTAKE LOUVERS ARE SUPPLIED FOR OUTDOOR UNITS.
3- DIMENSIONS GIVEN DO NOT INCLUDE 1 3/4" STANDING ROOF SEAMS, DOOR HANDLES OR 4" LIFTING LUGS.
4- HINGED ACCESS DOORS ARE PROVIDED FOR FILTER AND FAN ACCESS. REMOVABLE PANELS PROVIDE ACCESS TO OTHER COMPONENTS.
5- UNIT IS EQUIPPED WITH 1 1/2" FPT DRAIN CONNECTIONS, QUANTITY AND LOCATION AS SHOWN. EACH DRAIN MUST BE TRAPPED SEPARATELY. ANY DRAIN OR TRAP EXPOSED TO OUTSIDE AIR MUST BE HEAT TRACED BY OTHERS TO PERMIT DRAINAGE IN WINTER.
6- NUMBER OF CONDENSER FANS SHOWN MAY NOT BE ACTUAL NUMBER USED ON UNIT.
7- ALL DIMENSIONS IN INCHES, ± 0.25 INCH. UNIT WEIGHT IN POUNDS, ± 5.
INITIAL RELEASE
REVISIONS
ORDER NO 34835
DES CHAMPS
NATURAL BRIDGE STATION, VA
Swonder Ice Arena
MOACS
MECHANICAL LAYOUT
34835_M_AC01
MOACS 2.3.90D LAYERS USED: 0, 1, 2, 23, 24, 32, 3, 35, 42, 43, 46, 47, 7, 13, 8,


CURB SECTION VIEW
RUBBER GASKET
1 1/2" RIGID FIBERGLASS INSULATION
1 5/8
12
5
UNIT MOUNTING DETAIL
UNIT FLOOR
BASE FRAME
CURB MOUNTING FLANGE
EXTERIOR WALL
LIFTING LUG
ROOF CURB
PLAN VIEW
SIDE ELEVATION
CURB SUPPORTS (SEE NOTE 2)
NOTES:
1. CURB IS SHIPPED DISASSEMBLED. COMPLETE WITH INSTRUCTIONS AND HARDWARE FOR FIELD ASSEMBLY.
2. MAX NUMBER OF CURB SUPPORTS SHOWN. SUPPORT NOT INCLUDED IF NOT DIMENSIONED.
Max. Unit Weight: 14247 LBS
DIMENSION TABLE
A 343.75 121.75 115 225.75
B C D
DRAWING NOT TO SCALE
DES CHAMPS
NATURAL BRIDGE STATION, VA
ORDER NO. 34835
ORDER NAME Swonder Ice Arena
UNIT TYPE: MOACS
TITLE: ROOF CURB
SIZE: A
DWG NO 34835_M_AC03
MODEL: PY-W90-MWT100
SCALE: NTS
SHEET 1 OF 1
INITIAL RELEASE JAG 10/02/01
DESCRIPTION OR NOMENCLATURE BY DATE
REVISIONS
APPROVALS DATE
DRAWN: DLW 10/02/01
APP'D:
ACT'D:
UNIT TAG: RTU-5
CONFIGURATION: 3C
QUANTITY: 1
SHOP ORDER NUMBER 43998


POWER DISTRIBUTION BLOCK
UNIT MOUNTED FUSED DISCONNECT SWITCH
3 PHASE POWER CONNECTION
VOLTAGE = 460/60/3
FLA = 111.4
MCA = 117.9
MOP = 125.0
M1 OL1
SUPPLY FAN MOTOR 1800 RPM
M2 OL2
RETURN FAN MOTOR 1800 RPM
M3
COMPRESSOR #1 MOTOR
M4
COMPRESSOR #2 MOTOR
M5
COMPRESSOR #3 MOTOR
M6
COMPRESSOR #4 MOTOR
CONDENSING SECTION
360 MBH
M7
CONDENSER FAN MOTOR(S)
2 SHOWN
4 INCLUDED
VFD SPEED CONTROL
ENERGY RECOVERY WHEEL (ERW) MOTOR
120V TRF3
GAS FURNACE
24V TRF1
POWER FOR CONTROLS CLASS II
24V TRF2
POWER FOR CONTACTORS
MCACS 2.3.36D LAYERS USED: 0_1_20_25_10_11_12_17_18_7_21_22_15_24_3_26_4_6_28_9
DRAWING NOT TO SCALE
THE LISTED EQUIPMENT MANUFACTURER IS FOR REFERENCE ONLY.
DES CHAMPS RESERVES THE RIGHT TO SUBSTITUTE COMPARABLE EQUIPMENT.
LEGEND
M - CONTACTOR
OL - FAN MOTOR OVERLOAD
TRF - TRANSFORMER
FIELD WIRING
FACTORY WIRING
UNIT PANEL TERMINAL POINT
FUSE
REVISIONS
INITIAL RELEASE
DESCRIPTION OR NOMENCLATURE
ORDER NO. 34835
DES CHAMPS
NATURAL BRIDGE STATION, VA
ORDER NAME: Swonder Ice Arena
UNIT TYPE: MCACS
TITLE: WIRING DIAGRAM - POWER
DWG NO. 34835_E_AC01
MODEL: PV-W10-MWT100
SCALE: NTS
SHEET 1 OF 1
UNIT TAG: RTU-5
SHOP ORDER NUMBER 43998
CONFIGURATION: 3C
QUANTITY: 1
04/01_A

RTU-6 (Des Champs MWT-030)

Des Champs Laboratories, Inc.
MOACS Unit Performance

Box 220, Natural Bridge Station, VA 24579
Phone: (540) 291-1111 Fax: (540) 291-2211

9/28/01 1:16:52 PM Ver. 2.3.36
Marketing@Entrodyne.com

Order Name	Swonder Ice Arena	Location	IN
Order Number	34835 -- SON: 43999	Prepared By	DLW
(Qty) Model	(1) PV-W3-MWT030	Unit Tag	RTU-6
Representative	IAP/A.C. Systems	Engineering Firm	-
Altitude	0		

UNIT SELECTION DETAILS:

Unit Size	PV-W3-MWT030-7
Condenser MBH - Evaporator Coil Rows	120-4
Heating Options Chosen	300MBH Input (Nat. Gas Only)
Total Supply Air Flow, SCFM	3,000
Amount bypassed for Sensible Control, SCFM	0
Total Return Air Flow, SCFM	2,500

COOLING PERFORMANCE:

Unit Cooling Capacity, Total MBH (T1-T3)	316.4
Unit Cooling Capacity, Sensible/Latent MBH(T1-T3)	144.3/172.1
Coil Cooling Capacity, Total MBH (T2-T3)	120.8
Precool by Exchanger, Total MBH (T1-T2)	216.9
Compressor Power Consumption, KW	8.7
Moisture Removed by Unit, LBS/Hour	168.4

SUMMER TEMPERATURES:

Summer Outside Air Design, F (DB/WB)	(T1) 90.0/79.0
Entering Coil, F (DB/WB)	(T2) 62.7/60.6
Leaving Coil, F (DB)	(T3) 45.5
Supply, F (DB/WB)	(T4) 50.7/47.9
Summer Return Air Design, F (DB/%RH)	(T6) 55.0/70.0
Exhaust Outlet, F (DB/RH)	(T8) 84.1/64

HEATING PERFORMANCE: (Frost Protected)

Unit Heating Capacity, Total MBH (T1-T5)	274.8

WINTER TEMPERATURES:

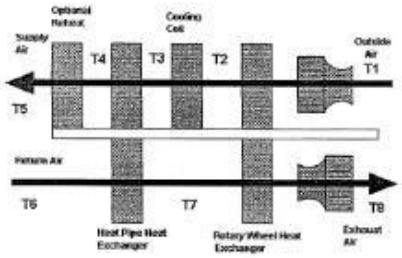
Winter Outside Air Design, F (DB/WB)	(T1)4.0/4.0
Aux. Heat Entering, F (DB)	(T4) 11.5
Leaving Air, F (DB/WB)	(T5) 85.6/53.9
Winter Return Air Design, F (DB/%RH)	(T6) 45.0/80.0
Exhaust Outlet, F (DB/RH)	(T8) 36.0/94

Des Champs Laboratories, Inc.
MOACS Unit Performance

Box 220, Natural Bridge Station, VA 24579
Phone: (540) 291-1111 Fax: (540) 291-2211

9/28/01 1:16:52 PM Ver. 2.3.36
Marketing@Entrodyne.com

Order Name	Swonder Ice Arena	Location	IN
Order Number	34835 -- SON: 43999	Prepared By	DLW
(Qty) Model	(1) PV-W3-MWT030	Unit Tag	RTU-6
Representative	IAP/A.C. Systems	Engineering Firm	-
Altitude	0		



Des Champs Laboratories, Inc.
MOACS Selection Details

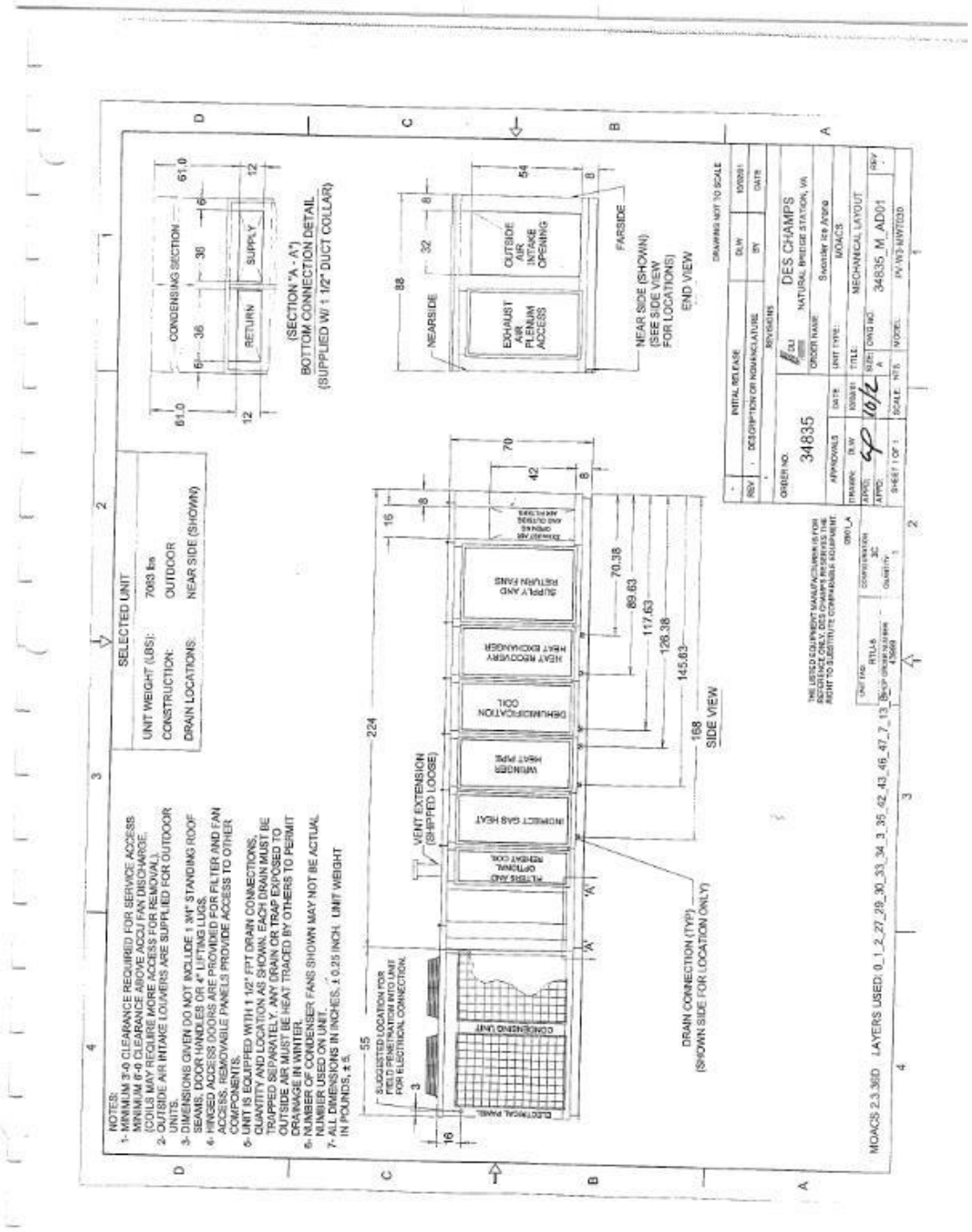
Box 220, Natural Bridge Station, VA 24579
Phone: (540) 291-1111 Fax: (540) 291-2211

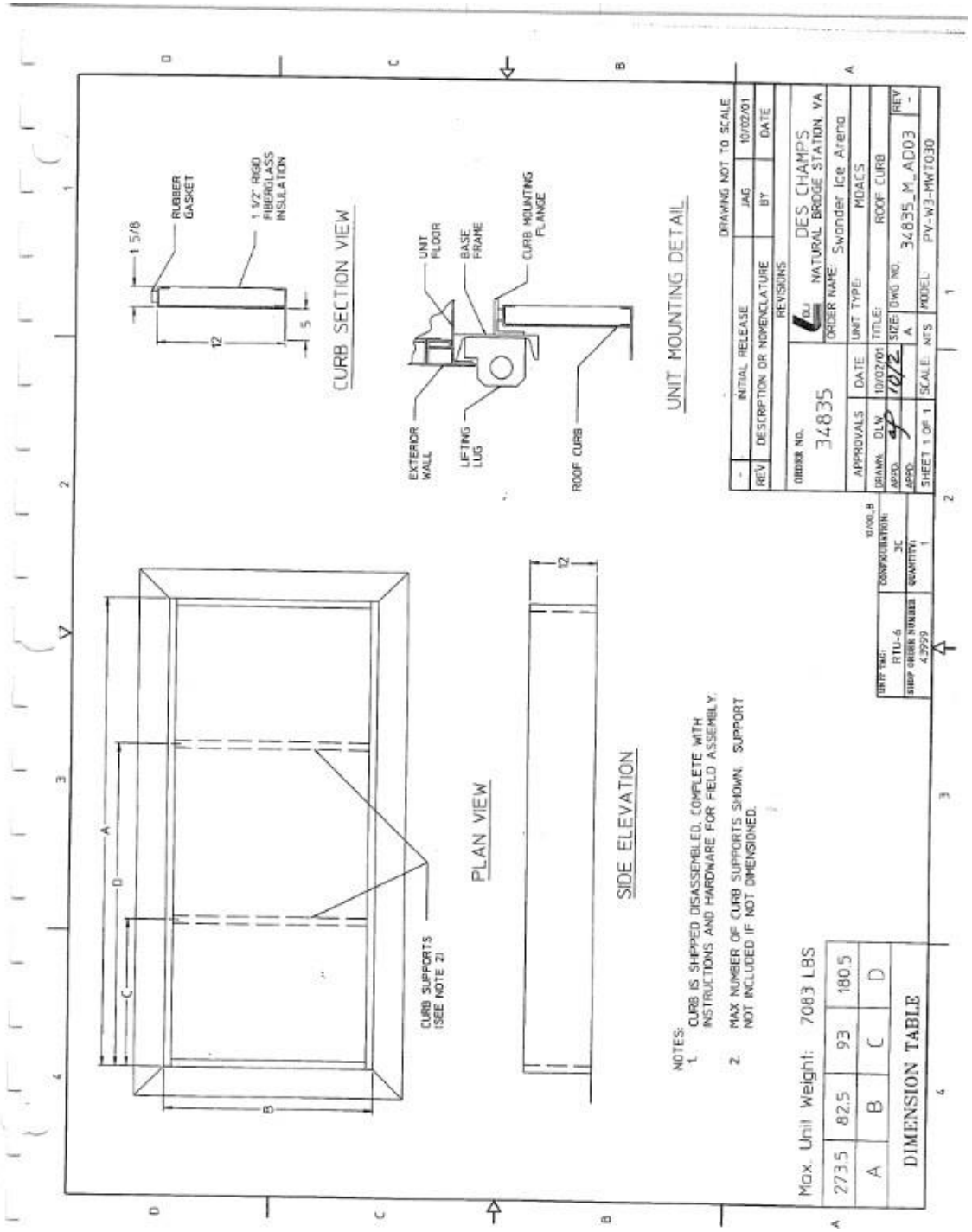
9/28/01 1:16:53 PM Ver. 2.3.36
Marketing@Entrodyne.com

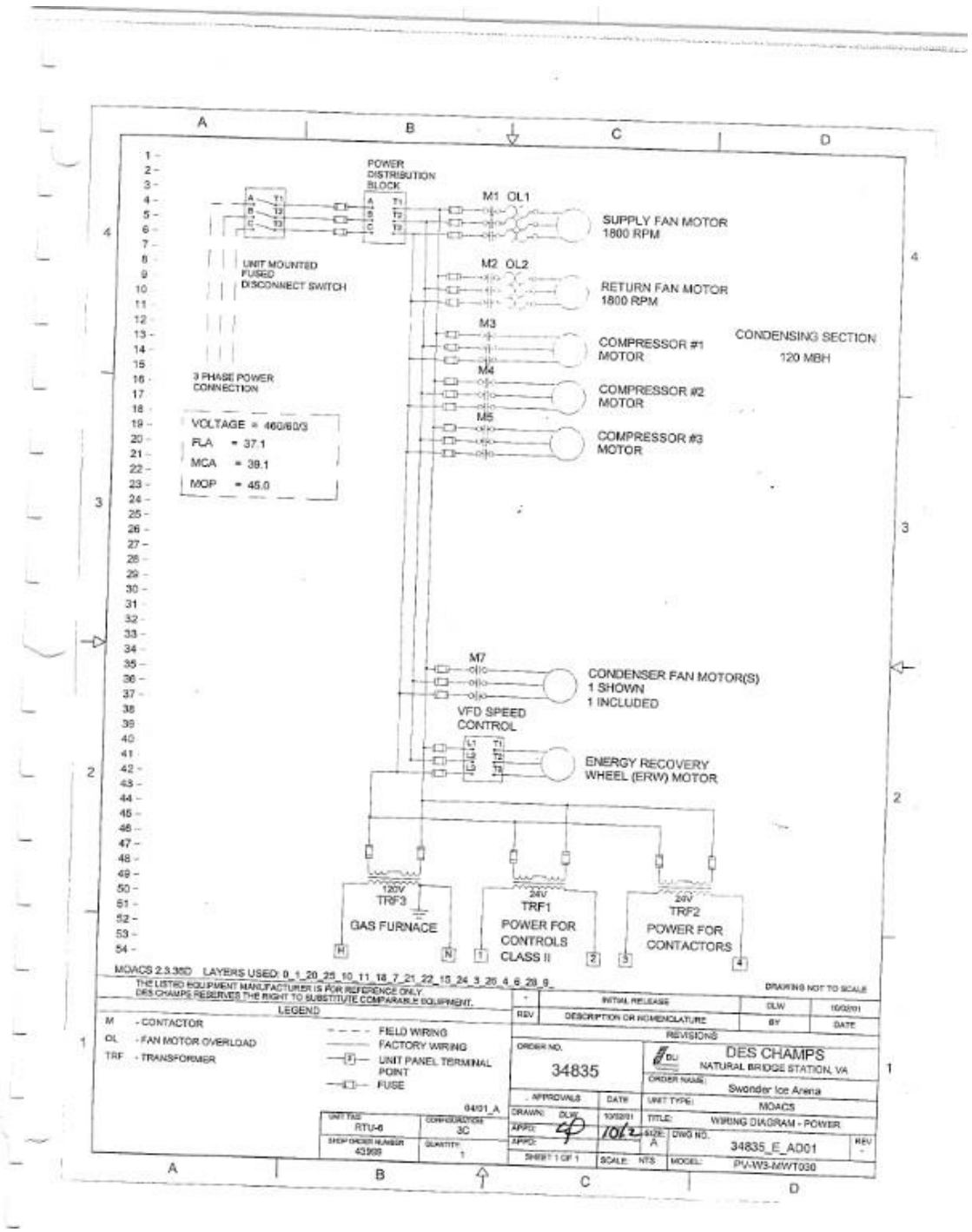
Order Name	Swonder Ice Arena	Location	IN
Order Number	34835 -- SON: 43999	Prepared By	DLW
(Qty) Model	(1) PV-W3-MWT030	Unit Tag	RTU-6
Representative	IAP/A.C. Systems	Engineering Firm	-
Altitude	0		

MODEL NUMBER: PV-W3-MWT030 CONFIGURATION: 3C

SELECTED UNIT DESCRIPTION:
PV-W3-MWT030 with 7 row heat pipe, 3000 SCFM Supply
and 2500 SCFM Return
COOLING: Direct Expansion (Integral Air Cooled Condenser)
»120 MBH nominal COOLING CAPACITY with a 4 ROW COIL
REHEAT: 300MBH Input (Nat. Gas Only) Indirect Gas Reheat
SUPPLY FAN: 18 in. diam. with 5 HP ODP High Eff. motor
»At 2035 RPM and 3.2 BHP (@ 1 in. ESP, 3.50 in. TSP)
»427 CFM allowed for rotary exchanger seal leakage
OUTSIDE AIR DAMPER: ~~2 position~~ low leak modulating
FACE & BYPASS DAMPERS: Modulating low leak
RECIRCULATION ~~2 position~~ low leak damper modulating
EXHAUST AIR DAMPER: ~~2 position~~ low leak modulating
TURN FAN:16 in. diam. with 3 HP ODP High Eff. MOTOR
»At 2165 RPM and 2.1 BHP (@ 1 in. ESP, 2.45 in. TSP)
»427 CFM allowed for rotary exchanger seal leakage
SUPPLY FILTERS: 2 Inch 30% Pleated
RETURN FILTERS: 2 Inch 30% Pleated
»All Filters Include an Anti-Microbial Coating
ELECTRICAL: 460/60/3
»37.1 Full Load Amps and 39.1 Minimum Circuit Ampacity
»45.0 Max Overcurrent Protection
»Unit Mounted DISCONNECT option
CONTROLS:Lvg.Air T--SpaceHum.--SpaceT--SupplyDewPt.
Summer:J_ - MIN.&MAX. --MAX.-- MIN.&MAX. -- MAX.
Winter:_D - MIN.&MAX. --NONE-- MIN.&MAX. -- NONE
»ETL listed
INSTALLATION: Outdoor, with Curb and with Louver (Seismic curb)
»SUPPLY AIR OUTLET: Bottom
»RETURN AIR INLET: Bottom
»DRAIN CONNECTION: Near side (Exhaust Air Outlet Side)
»FROST PROTECTION: VFD on Wheel & Bypass on Heat Pipe
»1 yr warranty
»Total Unit Weight: 7083 lbs


NOTES:
1- MINIMUM 3'-0 CLEARANCE REQUIRED FOR SERVICE ACCESS. MINIMUM 6'-0 CLEARANCE ABOVE ACCU FAN DISCHARGE. COILS MAY REQUIRE MORE ACCESS FOR REMOVAL).
2- OUTSIDE AIR INTAKE LOUVERS ARE SUPPLIED FOR OUTDOOR UNITS.
3- DIMENSIONS GIVEN DO NOT INCLUDE 1 3/4" STANDING ROOF SEAMS, DOOR HANDLES OR 4" LIFTING LUGS.
4- HINGED ACCESS DOORS ARE PROVIDED FOR FILTER AND FAN ACCESS. REMOVABLE PANELS PROVIDE ACCESS TO OTHER COMPONENTS.
5- UNIT IS EQUIPPED WITH 1 1/2" FPT DRAIN CONNECTIONS. QUANTITY AND LOCATION AS SHOWN. EACH DRAIN MUST BE TRAPPED SEPARATELY. ANY DRAIN OR TRAP EXPOSED TO OUTSIDE AIR MUST BE HEAT TRACED BY OTHERS TO PERMIT DRAINAGE IN WINTER.
6- NUMBER OF CONDENSER FANS SHOWN MAY NOT BE ACTUAL NUMBER USED ON UNIT.
7- ALL DIMENSIONS IN INCHES, ± 0.25 INCH. UNIT WEIGHT IN POUNDS, ± 5.
SELECTED UNIT
UNIT WEIGHT (LBS): 7093 lbs
CONSTRUCTION: OUTDOOR
DRAIN LOCATIONS: NEAR SIDE (SHOWN)
CONDENSING SECTION
RETURN
SUPPLY
(SECTION "A - A")
BOTTOM CONNECTION DETAIL
(SUPPLIED W/ 1 1/2" DUCT COLLAR)
NEARSIDE
EXHAUST AIR PLENUM ACCESS
OUTSIDE AIR INTAKE OPENING
FARSIDE
NEAR SIDE (SHOWN)
(SEE SIDE VIEW FOR LOCATIONS)
END VIEW
SUPPLY AND RETURN FANS
HEAT RECOVERY HEAT EXCHANGER
DEHUMIDIFICATION COIL
WINDER HEAT PIPE
INDIRECT GAS HEAT
FILTERS AND OPTIONAL REHEAT COIL
CONDENSING UNIT
VENT EXTENSION (SHIPPED LOOSE)
SUGGESTED LOCATION FOR FIELD PENETRATION INTO UNIT FOR ELECTRICAL CONNECTION.
DRAIN CONNECTION (TYP) (SHOWN SIDE FOR LOCATION ONLY)
70.38
89.63
117.63
126.38
145.63
168
SIDE VIEW
DRAWING NOT TO SCALE
ORDER NO. 34835
DES CHAMPS
NATURAL BRIDGE STATION, VA
ORDER NAME: Swonder Ice Arena
UNIT TYPE: MOACS
TITLE: MECHANICAL LAYOUT
DWG NO. 34835_M_AD01
MOACS 2.3-36D LAYERS USED: 0_1_2_27_28_30_33_34_3_35_42_43_46_47_7_13


CURB SECTION VIEW
RUBBER GASKET
1 1/2" RIGID FIBERGLASS INSULATION
1 5/8
12
5
UNIT MOUNTING DETAIL
UNIT FLOOR
BASE FRAME
CURB MOUNTING FLANGE
EXTERIOR WALL
LIFTING LUG
ROOF CURB
PLAN VIEW
SIDE ELEVATION
CURB SUPPORTS (SEE NOTE 2)
NOTES:
1. CURB IS SHIPPED DISASSEMBLED, COMPLETE WITH INSTRUCTIONS AND HARDWARE FOR FIELD ASSEMBLY.
2. MAX NUMBER OF CURB SUPPORTS SHOWN. SUPPORT NOT INCLUDED IF NOT DIMENSIONED.
Max. Unit Weight: 7083 LBS
DIMENSION TABLE
A 273.5
B 82.5
C 93
D 180.5
DRAWING NOT TO SCALE
INITIAL RELEASE
DESCRIPTION OR NOMENCLATURE
REVISIONS
ORDER NO. 34835
APPROVALS
DRAWN DLW 10/02/01
APPD.
APPD.
SHEET 1 OF 1
DES CHAMPS
NATURAL BRIDGE STATION, VA
ORDER NAME: Swonder Ice Arena
UNIT TYPE: MDACS
TITLE: ROOF CURB
DWG NO. 34835_M_A003
SIZE A
SCALE: NTS
MODEL: PV-W3-MWT030
UNIT TAG: RTU-6
SHOP ORDER NUMBER 43999
CONFIGURATION 3C
QUANTITY(S) 1


POWER DISTRIBUTION BLOCK
M1 OL1
SUPPLY FAN MOTOR 1800 RPM
M2 OL2
RETURN FAN MOTOR 1800 RPM
M3
COMPRESSOR #1 MOTOR
M4
COMPRESSOR #2 MOTOR
M5
COMPRESSOR #3 MOTOR
CONDENSING SECTION 120 MBH
UNIT MOUNTED FUSED DISCONNECT SWITCH
3 PHASE POWER CONNECTION
VOLTAGE = 460/60/3
FLA = 37.1
MCA = 39.1
MOP = 45.0
M7
CONDENSER FAN MOTOR(S) 1 SHOWN 1 INCLUDED
VFD SPEED CONTROL
ENERGY RECOVERY WHEEL (ERW) MOTOR
120V TRF3 GAS FURNACE
24V TRF1 POWER FOR CONTROLS CLASS II
24V TRF2 POWER FOR CONTACTORS
MOACS 2.3.35D LAYERS USED: 0_1_20_25_10_11_18_7_21_22_15_24_3_26_4_6_29_9_
THE LISTED EQUIPMENT MANUFACTURER IS FOR REFERENCE ONLY
DES CHAMPS RESERVES THE RIGHT TO SUBSTITUTE COMPARABLE EQUIPMENT.
DRAWING NOT TO SCALE
LEGEND
M - CONTACTOR
OL - FAN MOTOR OVERLOAD
TRF - TRANSFORMER
FIELD WIRING
FACTORY WIRING
UNIT PANEL TERMINAL POINT
FUSE
REVISIONS
INITIAL RELEASE
DESCRIPTION OR NOMENCLATURE
ORDER NO. 34835
DES CHAMPS NATURAL BRIDGE STATION, VA
ORDER NAME: Swonder Ice Arena
APPROVALS
DRAWN: DLW 10/02/01
APPD:
UNIT TYPE: MOACS
TITLE: WIRING DIAGRAM - POWER
SIZE: A
DWG NO. 34835_E_AD01
SCALE: NTS
MODEL: PV-W3-MWT030
SHEET 1 OF 1
UNIT TAG: RTU-6
CONFIGURATION: 3C
SHOP ORDER NUMBER: 43998
QUANTITY: 1
04/01_A

5.0 Project Schedule

5.1 Refer to the City of Evansville Vendor Instructions included in this bid package for the project schedule, significant dates, and bid instructions.

5.2 Original construction reference drawings are available from the Owner upon request

SECTION 230900 - HVAC INSTRUMENTATION AND CONTROLS

PART 2 - GENERAL

2.1 DESCRIPTION

A. General: The Building management system (BMS) system shall consist of a high-speed, peer-to-peer network of DDC controllers, a control system server, and a web-based operator interface.

B. System software shall be based on a server/thin-client architecture, designed around the open standards of web technology. The control system server shall be accessed using a Web browser over the control system network, the owner's local area network and (at the owner's discretion) over the Internet. The server shall also act as a "workstation" when running as a server/client platform. Additional clients shall have concurrent access to the "workstation" in this mode.

C. The intent of the thin-client architecture is to provide operators complete access to the control system via a Web browser. No special software other than a Web browser shall be required to access graphics, point displays, and trends, configure trends, configure points and controllers, or to download programming into the controllers.

D. System shall use BACnet protocol for communication between the control modules and web server. Communication between the web server and the user's browser shall be HTTP or HTTPS protocol utilizing HTML5. Use of Adobe Flash technology is not acceptable.

2.2 QUALITY ASSURANCE

A. Installer and Manufacturer Qualifications

1. Installer shall have an established working relationship with the Control System Manufacturer and have, as a minimum, 5 years demonstrated experience with installation and support of the manufacturer's product

2. Installer shall have successfully completed Control System Manufacturer's control system training. Upon request, Installer shall present record of completed training including course outlines.

2.3 CODES AND STANDARDS

A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances for these plans and specifications. As a minimum, the installation shall comply with current editions in effect 30 days prior to receipt of bids of the following codes:

1. National Electric Code (NEC)

2. International Building Code (IBC)

3. International Mechanical Code (IMC)

4. Underwriters Laboratories (UL/CUL)

5. ANSI/ASHRAE Standard 135, BACnet – A Data Communication Protocol for Building Automation and Control Systems.

2.4 SYSTEM PERFORMANCE

A. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for display through the user's web browser.

B. Graphic Display. A graphic with 20 dynamic points shall display with current data within 10 sec.

C. Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 sec.

D. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 sec.

E. Object Command. Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.

F. Alarm Response Time. An object that goes into alarm shall be annunciated at the browser within 45 sec.

G. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 sec.

H. Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.

I. Multiple Alarm Annunciation. Each user, connected to network accessing the system through their browser (workstation), shall receive alarms within 5 seconds of one another.

J. Control Stability and Accuracy. Control loops shall maintain measured variable at setpoint within tolerances shown in table below:

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±0.2 in. w.g. (±0.01 in. w.g.	0–6 in. w.g. –0.1 to 0.1 in. w.g.
Airflow	±10% of full scale	
Space Temperature	±2.0ºF	
Duct Temperature	±2.0ºF	
Humidity	±5% RH	

Fluid Pressure	±1.5 psi ±1.0 in. w.g	1–150 psi 0–50 in. w.g. differential

PART 3 - PRODUCTS

3.1 MATERIALS

B. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner. Spare parts shall be available for at least five years after completion of this contract.

3.2 COMMUNICATION

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135, BACnet.

B. All IP based controllers shall be capable of providing IPv4 and IPv6 protocol standards as defined by the Internet Data Communications Standard.

C. The BMS contractor shall furnish and install all communication media, connectors, repeaters and network switches/routers, and network devices necessary to provide a complete and workable control network for both high speed Ethernet communications network/LAN and serial networks. The control network shall adhere to the owner's testing, labeling, administration, and documentation requirements established and presented for the site. The dedicated controls network shall be capable of connecting to a separate owner/customer LAN.

D. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.

E. Internetwork operator interface and value passing shall be transparent to internetwork architecture.

1. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, and control algorithms shall be viewable and editable from each internetwork controller.

2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute specified sequences of operations. An authorized operator shall be able to edit cross-controller links by typing a standard object address or by using a point-and-click interface.

F. BACnet Secure Connect (BACnet/SC). BACnet/SC is a datalink option that makes the full use of TLS WebSocket connections as defined by addendum bj to the ANSI/ASHRAE Standard 135.

1. The BMS contractor shall furnish and install a network designed to allow for implementation of BACnet/SC. The network shall be installed with as many devices capable of using BACnet/SC at time of installation.

2. The BMS contractor shall furnish and install all BACnet workstations/servers, routers, and building controllers capable of using BACnet/SC. Any BACnet workstations/servers, routers, or building controllers that do not have BACnet/SC capability at time of installation shall have the ability to provide BACnet/SC capability with a software/firmware update/patch. BACnet/SC capability shall not require the physical replacement of the BACnet workstation/server, router, or building controller hardware.

G. Building Control Panels and Controllers with real-time clocks shall use the BACnet Time Synchronization service. System shall automatically synchronize system clocks daily from an operator-designated device via the internetwork. The system shall automatically adjust for daylight saving and standard time as applicable.

H. System shall be expandable to at least twice the required BACnet objects. No additional licensing/software fees shall be required to add controllers, associated devices, and wiring.

I. System shall support Web services data exchange with any other system that complies with XML (extensible markup language) and SOAP (simple object access protocol) standards. Web services support shall as a minimum be provided at the workstation or web server level and shall enable data to be read from or written to the system.

1. System shall support Web services read data requests by retrieving requested trend data or point values (I/O hardware points, analog value software points, or binary value software points) from any system controller or from the trend history database.

2. System shall support Web services write data request to each analog and binary object that can be edited through the system operator interface by downloading a numeric value to the specified object.

3. For read or write requests, the system shall require username and password authentication and shall support TLS (Transport Layer Security) or equivalent data encryption.

4. System shall support discovery through a Web services connection or shall provide a tool available through the Operator Interface that will reveal the path/identifier needed to allow a third party Web services device to read data from or write data to any object in the system which supports this service.

3.3 OPERATOR INTERFACE

A. Operator Interface. The web server shall reside on a high-speed network with the building controllers. Web pages generated by this server shall be compatible with the latest versions of Microsoft Internet Explorer or Edge, Google Chrome, Mozilla Firefox, and Apple Safari browsers. Any of these supported browsers connected to the server shall be able to access all system information. Mobile devices shall be recognized by the web

server and shall supply the appropriate system content as needed. The Operator Interface (web server with client devices) shall conform to the BACnet Operator Workstation (B-OWS) or BACnet Advanced Workstation (B-AWS) device profile as specified in ASHRAE/ANSI 135 BACnet Annex L. This includes the ability to configure and/or reconfigure the system from the client device (change programs, graphics, labels, etc.).

B. Communication. Web server and controllers shall communicate using BACnet protocol, including BACnet/SC. Web server and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ANSI/ASHRAE 135, BACnet Annex J. Communication between the web server and client (workstation) shall be HTTP or HTTPS protocol utilizing HTML5 language. Use of Adobe Flash in any part of the communication infrastructure is not acceptable.

C. Hardware.

1. Web server and/or workstation. Industry-standard hardware shall meet or exceed DDC system manufacturer's recommended specifications and shall meet response times specified elsewhere in this document. The web server may also be configured in client/server fashion to accommodate a "workstation" definition. In "workstation" configuration, the workstation will also perform as a server supplying additional clients as needed. The following hardware requirements apply:

a. System storage shall have sufficient memory to accommodate:

1) All required system software.

2) A DDC database to accommodate, as a minimum, twice the size of the delivered system database.

3) One year of archival trend data based on the points specified to be trended at their specified trend intervals.

b. Provide additional hardware (communication ports, video drivers, network interface cards, cabling, etc.) to facilitate all control functions and software requirements specified for the DDC system.

c. Minimum hardware configuration shall include the following:

1) Quad Core Processor

2) 4-24 GB RAM (size dependent on size of system)

3) 500 GB hard disk providing data at 3.0 Gb/sec (size dependent on historical data storage requirements)

4) 16x DVD+/-RW drive

5) Qwerty Keyboard

6) Optical Mouse

7) 24-inch LED Color monitor with 75Hz refresh rate and 1080P resolution to provide a minimum screen resolution of 1920 x 1080 pixels.

8) Serial (USB) and network communication ports, with cables as required for proper DDC system operation

D. System Software.

1. Operating System. Web server shall have an industry-standard professional-grade operating system. Operating system shall meet or exceed the BMS manufacturer's minimum requirements for their software. Acceptable systems include Microsoft Windows 8.1 or 10, Windows Server 2012 R2 or 2016 or 2019 or 2020, Red Hat Enterprise Linux 8.3, or Ubuntu Desktop 18.04 or 20.04 TLS.

2. Security. The web server application shall support Transport Layer Security (TLS) 1.3 capable of encryption of up to 256 bit elliptical curve for transmitting private information over the Internet using HTTPS. Additionally, the web server shall have SHA-2 certificate support capability.

3. Database. System shall support any JDBC (Java DataBase Connectivity) compliant engine. This includes MS SQL, My SQL, Apache Derby, PostgreSQL, and Oracle.

4. The BMS system shall allow an unlimited number of concurrent users.

5. The BMS manufacturer shall provide all software and tools necessary to provide the following capabilities:

   a. Create and/or edit any programming used in controllers

   b. Create and/or edit any graphics used in the system

   c. Software shall not be subscription based and be given to owner at time of turnover. If software is subscription based, manufacturer shall include 10 years of subscription service.

   d. The owner shall have the ability to install software on a minimum of five (5) additional owner furnished computers without additional licenses or fees.

6. System Graphics. The operator interface software shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using dynamic colors to represent zone temperature relative to zone setpoint.

   a. Minimum graphics resolution shall be 1920 x1080 for display of detailed system graphics.

b. Floor Plan Graphics. Floor plan graphics shall be Scalable Vector Graphics (SVG) capable of allowing the floor plan graphic to dynamically size relative to the end user's monitor resolution.

c. Functionality. Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point-and-click navigation between zones or equipment, and to edit setpoints and other specified parameters.

d. Animation. Graphics shall be able to animate by displaying different image files for changed object status.

e. Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.

f. Format. Graphics shall be saved in an industry-standard format such as BMP, JPEG, PNG, GIF, or SVG. Web-based system graphics shall be viewable on browsers compatible with World Wide Web Consortium browser standards. Web graphic format shall require no plug-in) or shall only require widely available no-cost plug-ins (such as Active-X or Adobe Flash).

7. Custom Graphics. Custom graphic files shall be created with the use of a graphics generation package furnished with the system. The graphics generation package shall be a graphically based system to create and modify graphics that are saved in the same formats as are used for system graphics.

8. Graphics Library. Furnish a complete library of standard HVAC equipment graphics such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. This library also shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program.

E. System Applications. System shall provide the following functionality to authorized operators as an integral part of the operator interface or as stand-alone software programs. If furnished as part of the interface, the tool shall be available from each workstation or web browser interface. If furnished as a stand-alone program, software shall be installable on standard PC type personal computer with no limit on the number of copies that can be installed under the system license.

1. Automatic System Database Configuration. Each workstation or web server shall store on its hard disk a copy of the current system database, including controller firmware and software. Stored database shall be automatically updated with each system configuration or controller firmware or software change.

2. Manual Controller Memory Download. Operators shall be able to download memory from the system database to each controller.

3. System Configuration. The workstation software shall provide a method of configuring the system. This shall allow for future system changes or additions by users under proper password.

4. On-Line Help. Provide a context-sensitive, on-line help system to assist the operator in operating and editing the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext.

5. Video Training. Provide on-line video support to supplement on-line help assistance. Video content shall be relevant and support existing system documentation.

6. Security. Each operator shall be required to log on to the system with a user name and password in order to view, edit, add, or delete data.

    a. Operator Access. The user name and password combination shall define accessible viewing, editing, adding, and deleting privileges for that operator. Users with system administrator rights shall be able to create new users and edit the privileges of all existing users. System Administrators shall also be able to vary and deny each operator's privileges based on the geographic location, such as the ability to edit operating parameters in Building A, to view but not edit parameters in Building B, and to not even see equipment in Building C.

    b. Password Policy Rules. System administrator shall invoke policies for minimum password strength, including number of characters, special characters and numbers, upper and lower case, etc.

    c. Automatic Log Out. Automatically log out each operator if no keyboard or mouse activity is detected. This auto logoff time shall be user adjustable.

    d. Encrypted Security Data. Store system security data including operator passwords in an encrypted format. System shall not display operator passwords.

7. System Diagnostics. The system shall automatically monitor the operation of all building management panels and controllers. The failure of any device shall be annunciated to the operator

8. Alarm Processing. System input and status objects shall be configurable to alarm on departing from and on returning to normal state. Operator shall be able to enable or disable each alarm and to configure alarm limits, alarm limit differentials, alarm states, and alarm reactions for each system object. Configure and enable alarm points as required by sequences of operation. Alarms shall be BACnet alarm objects and shall use BACnet alarm services. BMS system shall be capable of assigning alarm sources to categories such as HVAC Critical, or HVAC General. The BMS shall include at a minimum HVAC and FDD categories. BMS system shall allow user to create custom alarm categories.

9. Alarm Messages. Alarm messages shall use the English language descriptor for the object in alarm in such a way that the operator will be able to recognize the source, location, and nature of the alarm without relying on acronyms or mnemonics.

10. Alarm Reactions. Operator shall be able to configure (by object) what, if any actions are to be taken during an alarm. As a minimum, the workstation or web server shall be able to log, print, start programs, display messages, send e-mail, send SMS text, and audibly annunciate.

11. Alarm and Event log. Operators shall be able to view all system alarms and changes of state from any location in the system. Events shall be listed chronologically. An operator with the proper security level may acknowledge and delete alarms, and archive closed alarms to the workstation or web server hard.

12. Trend Logs. The operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system data object and shall be able to retrieve data for use in spreadsheets and standard database programs. Controller shall sample and store trend data and shall be able to archive data to the hard disk. Configure trends as required by the sequences of operations. Trends shall be BACnet trend objects. As a minimum, all physical points in the system shall be trended within the local controller (AAC, ASC, BC) for at least 277 samples per point. Selected points, as desired, shall be available for historical archiving within the server. The historical archiving capability cannot be less than 2 years.

13. Object and Property Status and Control. Provide a method for the operator to view, and edit if applicable, the status of any object or property in the system. The status shall be available by menu, on graphics, or through custom programs.

14. Reports and Logs. Operator shall be able to select, to modify, to create, and to print reports and logs. Operator shall be able to store report data in a format accessible by standard spreadsheet and word processing programs.

15. Audit and Security Detail. All users accessing the system shall have their actions recorded. Information recorded shall include:

    a. login/logout time and date

    b. system modifications – with before and after values

    c. ability to report user activity based on individual and/or date and time.

16. Standard Reports. Furnish the following standard system reports:

    a. Objects. System objects and current values filtered by object type, by status (in alarm, locked, normal), by equipment, by geographic location, or by combination of filter criteria.

    b. Alarm Summary. Current alarms and closed alarms. System shall retain closed alarms for an adjustable period.

    c. Logs. System shall log the following to a database or text file and shall retain data for an adjustable period:

        1) Alarm History.

2) Trend Data. Operator shall be able to select trends to be logged.

17. Custom Reports. Operator shall be able to create custom reports that retrieve data, including archived trend data, from the system, that analyze data using common algebraic calculations, and that present results in tabular or graphical format. Reports shall be launched from the operator interface. Operator shall be able to schedule reports to automatically run and be emailed to recipients on a recurring basis from the BMS system.

18. Logic Page. System shall allow operator to view all application software in real time for all controllers furnished and installed by BMS manufacturer.

19. Environmental Index. System shall monitor all occupied zones and compile an index that provides a numerical indication of the environmental comfort within the zone. As a minimum, this indication shall be based upon the deviation of the zone temperature from the heating or cooling setpoint. If humidity is being measured within the zone then the environmental index shall be adjusted to reflect a lower comfort level for high or low humidity levels. Similarly, if carbon dioxide levels are being measured as an indication of ventilation effectiveness then the environmental index shall be adjusted to indicate degraded comfort at high carbon dioxide levels. Other adjustments may be made to the environmental index based upon additional measurements. The system shall maintain a trend of the environmental index for each zone in the trend log. The system shall also compute an average comfort index for every building included in this contract and maintain trend logs of these building environmental indices. Similarly, the system shall compute the percentage of occupied time that comfortable conditions were maintained within the zones. Through the UI the user shall be able to add a weighting factor to adjust the contribution of each zone to the average index based upon the floor area of the zone, importance of the zone, or other static criteria.

20. Indoor Environmental Quality Index (IEQ)

    a. System shall monitor up to ten building conditions and compile an index that provides a numerical indication of the overall building environmental quality and health. A graphical dashboard indicating each measured building condition name, a description of each measured building condition, the current value of each measured building condition, and the overall building IEQ value. In addition, an historical trend graph of the IEQ Index and/or individual health components shall also be displayed The IEQ numerical value indication shall be 0-100 with 0 being the worst and 100 the best. The IEQ shall be calculated using an algorithm that aggregates all of the selected building conditions and allows the user to define the acceptable ranges for each monitored building condition. In addition, the user shall have the ability assign a weighting/importance factor to each building condition that determines the impact the monitored building condition has on the overall IEQ index calculation. The IEQ value graphical representation shall have the ability to display one of a minimum of four (4) colors based on the IEQ value and the user adjustable range for each color. The default IEQ ranges and colors shall be as follows:

        1) Less than 85 = Red

2) 85 to 89.9 = Orange

3) 90 to 94.9 = Yellow

4) 95 to 100 = Green

b. The system shall allow the user to select from one of the following ten building conditions:

1) Temperature, average area

2) Humidity, average area

3) Carbon Dioxide, average area

4) Volatile Organic Compounds, average area

5) % Dirty Filters, % dirty filter switches

6) % Occupied, of expected occupants

7) Air Purifiers, Total counted purifiers

8) % OA of Design, % Total OA cfm of buildings design.

9) CFM per Person, Average outside air flow per occupant

10) % Time Above minimum, % of time outside air dampers are above the minimum when occupied (average of all).

21. Time Lapse Graphic Replay. Operator shall be able to "replay" any graphic in the system to see how key values changed over an operator-selected period of time. Operator shall be able to select the starting date/time for this display and the end date/time or the display period. System shall then display the graphic as it would have looked at the beginning of that period, displaying key data, dynamic colors, etc. based upon values recorded at the start time. When the operator starts the replay the graphics and key values shall dynamically change to produce the effect of "fast forwarding" through the designated period of time. Once the system has been operational for at least 30 days, the contractor shall demonstrate that up to 24 hours of data from within the last 30 days can be replayed on any graphic page. Owner's representative shall choose the graphic pages for this demonstration at the time of the demonstration.

22. Semantic Tagging. The BMS system shall include a semantic tagging engine that uses the Project Haystack library of descriptive tagging for building equipment and systems used in the BMS. The Project Haystack naming tags used by the BMS shall be a library that includes a comprehensive list of standard tag names to address common equipment, building systems, and device types. The library tag of names shall include at a minimum the tag names listed in ASHRAE Standard 223P.

23. Network Health Monitoring.

    a. The BAS shall allow for monitoring of the network system health through the use of a remote cloud based analytics platform. The BAS vendor shall provide to the owner a baseline report of the building network health at project completion and then once again at the end of the warranty period. The health monitoring application provides insights into the health of the BAS system for system maintenance and usage. This application will provide at a minimum the following information for the BAS network:

        1) BAS Server

            a) Online status/availability

            b) CPU and memory usage

            c) JAVA Container Health: Memory usage patterns and allocation to overall server resources

        2) BACnet Controllers

            a) Memory usage: Controller flash and database utilization

            b) Critical errors: Controller and watchdog errors

            c) Network communications health: Transmit and receive patterns and identification of controllers that may be causing errors

        3) Network System Inventory

            a) BAS Server software version

            b) Controller driver versions

            c) Controller upgrade requirements

    b. At the completion of the warranty period, the owner shall have the option of continuing the remote network health monitoring service as part of an ongoing service contract negotiated with the BAS provider for an additional fee.

24. VAV Auto-Commissioning. The BMS system shall provide an auto-commissioning tool to commission single duct, dual duct, parallel and series flow fan powered VAV terminal units with or without hot water reheat.

    a. This tool shall be available for use during the construction phase of the project.

    b. The auto-commissioning tool shall run a set of functional tests to automatically exercise dampers and reheat valves in the VAV system.

c. The user shall be able to schedule when the functional testing of a VAV system is to be done.

d. The auto-commissioning tool shall be capable of detecting the following faults:

1) Obstruction

2) Over-Stroking

3) Under Stroking

4) Leakage

5) Stuck

6) Sensor Issue

7) Reverse Stroking

8) AHU Pressure Error

9) Data Inconsistent

10) Actuation Range Insufficient

11) Data Insufficient

12) Data Unavailable

13) Expert Diagnosis Required

14) Maximum Airflow Error

15) Minimum Airflow Error

e. The tool shall be capable of exporting an excel file or printing a file in PDF format that provides a detailed report.

f. A baseline commissioning report shall be provided for all VAV systems at the completion of the project.

25. Weather Data. The BMS system shall retrieve current weather conditions from a data source such as AccuWeather. This weather information shall be displayed on a graphic page and be capable for use in control logic.

F. Workstation Application Editors. Each PC or browser workstation shall support editing of all system applications. The applications shall be downloaded and executed at one or more of the controller panels

1. Controller. Provide a full-screen editor for each type of application that shall allow the operator to view and change the configuration, name, control parameters, and set points for all controllers.

2. Scheduling. An editor for the scheduling application shall be provided at each workstation. Provide a method of selecting the desired schedule and schedule type. Exception schedules and holidays shall be shown clearly on the calendar. The start and stop times for each object shall be adjustable from this interface.

3. Custom Application Programming. Provide the tools to create, edit, debug, and download custom programs. System shall be fully operable while custom programs are edited, compiled, and downloaded. Programming language shall have the following features:

    a. Language. Language shall be graphically based and shall use function blocks arranged in a logic diagram that clearly shows control logic flow. Function blocks shall directly provide functions listed below, and operators shall be able to create custom or compound function blocks.

    b. Programming Environment. Tool shall provide a full-screen, cursor-and-mouse-driven programming environment that incorporates word processing features such as cut and paste. Operators shall be able to insert, add, modify, and delete custom programming code, and to copy blocks of code to a file library for reuse in other control programs.

    c. Independent Program Modules. Operator shall be able to develop independently executing program modules that can disable, enable and exchange data with other program modules.

    d. Debugging and Simulation. Operator shall be able to step through the program observing intermediate values and results. Operator shall be able to adjust input variables to simulate actual operating conditions. Operator shall be able to adjust each step’s time increment to observe operation of delays, integrators, and other time-sensitive control logic. Debugger shall provide error messages for syntax and for execution errors.

    e. Conditional Statements. Operator shall be able to program conditional logic using compound Boolean (AND, OR, and NOT) and relational (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.

    f. Mathematical Functions. Language shall support floating-point addition, subtraction, multiplication, division, and square root operations, as well as absolute value calculation and programmatic selection of minimum and maximum values from a list of values.

    g. Variables. Operator shall be able to use variable values in program conditional statements and mathematical functions.

        1) Time Variables. Operator shall be able to use predefined variables to represent time of day, day of the week, month of the year, and date. Other predefined variables or simple control logic shall provide

elapsed time in seconds, minutes, hours, and days. Operator shall be able to start, stop, and reset elapsed time variables using the program language.

2) System Variables. Operator shall be able to use predefined variables to represent status and results of Controller Software and shall be able to enable, disable, and change setpoints of Controller Software as described in Controller Software section.

3.4 CONTROLLER SOFTWARE

A. All controller software applications shall reside and operate in the system controllers.

B. All application software in controllers furnished by BMS manufacturer shall be editable through operator workstation, web browser interface, or workstation.

C. Each controller furnished by BMS manufacturer shall have all of its local on board software applications backed up and saved to the BMS web server. In the event of a controller failure, the BMS server shall download backed up software applications to replacement controller. Controllers furnished by others and integrated into the BMS are not required to be backed up to BMS server.

D. Furnish the following applications for building and energy management:

1. System Security.

2. Scheduling. Provide the capability to execute control functions according to a user created or edited schedule. Each schedule shall provide the following schedule options as a minimum:

3. Weekly Schedule. Provide separate schedules for each day of the week. Each schedule shall be able to include up to 5 occupied periods (5 start-stop pairs or 10 events).

4. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. Exception schedules may be defined up to a year in advance. Once an exception schedule has executed, the system shall discard and replace the exception schedule with the standard schedule for that day of the week.

5. Holiday Schedules. Provide the capability for the operator to define up to 24 special or holiday schedules These schedules will be repeated each year. The operator shall be able to define the length of each holiday period. System Coordination. Operator shall be able to group related equipment based on function and location and to use these groups for scheduling and other applications.

6. Binary Alarms. Each binary object shall have the capability to be configured to alarm based on the operator-specified state. Provide the capability to automatically and manually disable alarming.

7. Analog Alarms. Each analog object shall have both high and low alarm limits. The operator shall be able to enable or disable these alarms.

8. Alarm Reporting. The operator shall be able to determine the action to be taken in the event of an alarm. An alarm shall be able to start programs, print, be logged in the event log, generate custom messages, and display on graphics.

9. Remote Communication. System shall automatically contact operator workstation or server on receipt of critical alarms. If no network connection is available, system shall use a modem connection.

10. Demand Limiting.

    a. The demand-limiting program shall monitor building power consumption from a building power meter (provided by others) which generates pulse signals or a BACnet communications interface. An acceptable alternative is for the system to monitor a watt transducer or current transformer attached to the building feeder lines.

    b. When power consumption exceeds adjustable levels, system shall automatically adjust setpoints, de-energize low-priority equipment, and take other programmatic actions to reduce demand as specified in sequences of operation. When demand drops below adjustable levels, system shall restore loads as specified.

11. Maintenance Management. The system shall be capable of generating maintenance alarms when equipment exceeds adjustable runtime, equipment starts, or performance limits. Configure and enable maintenance alarms as specified in sequences of operations.

12. Sequencing. Application software shall sequence each piece of equipment as required by the specified sequences of operations.

13. PID Control. System shall provide direct- and reverse-acting PID (proportional-integral-derivative) algorithms. Each algorithm shall have anti-windup and selectable controlled variable, setpoint, and PID gains. Each algorithm shall calculate a time-varying analog value that can be used to position an output or to stage a series of outputs. The calculation interval, PID gains, and other tuning parameters shall be adjustable by a user with the correct security level.

14. Staggered Start. System shall stagger controlled equipment restart after power outage. Operator shall be able to adjust equipment restart order and time delay between equipment restarts.

15. Energy Calculations.

    a. The system shall accumulate and convert instantaneous power (kW) or flow rates (gpm) to energy usage data.

    b. The system shall calculate a sliding-window average (rolling average). Operator shall be able to adjust window interval to 15 minutes, 30 minutes, or 60 minutes.

16. Anti-Short Cycling. All binary output objects shall be protected from short cycling by means of adjustable minimum on-time and off-time settings.

17. On and Off Control with Differential. Provide an algorithm that allows a binary output to be cycled based on a controlled variable and a setpoint. The algorithm shall be direct-acting or reverse-acting.

18. Runtime Totalization. Provide software to totalize runtime for each binary input and output. Operator shall be able to enable runtime alarm based on exceeded adjustable runtime limit. Configure and enable runtime totalization and alarms as required by Sequence of Operations.

19. Fault Detection and Diagnostics (FDD). The system shall follow NIST and ASHRAE standards for enhanced monitoring and alarming. The FDD shall reside in the controller and be integral to the programming. Overlay software for primary FDD reporting is not acceptable. FDD capabilities shall include diagnostics for: Simultaneous Heating and Cooling; Continuous Operation; Fraction of Outdoor Air; Analog Output Cycling; Discrete Output Cycling; Sensor Failures; and Run Requests Analytics. These FDD alarms must be fully programmed, configured and active within the system. It is not acceptable for the system to have simply have the capability for FDD alarming, the alarming must be fully functional. The alarms shall be categorized and displayed on the BMS system. The FDD alarms shall categorized into one of the following four categories:

    a. FDD Comfort

    b. FDD Critical

    c. FDD Energy

    d. FDD Maintenance

3.5 CONTROLLERS

A. General. Provide an adequate number of Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), Smart Actuators (SA), and Smart Sensors (SS) as required to achieve performance as specified by system performance. Every device in the system which executes control logic and directly controls HVAC equipment must conform to a standard BACnet Device profile as specified in ANSI/ASHRAE 135, BACnet Annex L. Unless otherwise specified, hardwired actuators and sensors may be used in lieu of communicating actuators, communicating sensors, BACnet Smart Actuators, and BACnet Smart Sensors

B. BACnet.

1. Building Controllers (BCs): Each BC shall conform to BACnet Building Controller (B-BC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L, and shall be listed as a certified B-BC in the BACnet Testing Laboratories (BTL) Product Listing.

2. Advanced Application Controllers (AACs): Each AAC shall conform to BACnet Advanced Application Controller (B-AAC) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-AAC in the BACnet Testing Laboratories (BTL) Product Listing.

3. Smart Actuators (SAs): An actuator which is controlled by a network connection rather than a binary or analog signal (0-10v, 4-20mA, relay, etc.). Each SA shall conform to BACnet Smart Actuator (B-SA) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-SA in the BACnet Testing Laboratories (BTL) Product Listing.

4. Smart Sensors (SSs): A sensor which provides information to the BAS via network connection rather than a binary or analog signal (0-10000 ohm, 4-20mA, dry contact, etc.). Each SS shall conform to BACnet Smart Sensor (B-SS) device profile as specified in ANSI/ASHRAE 135, BACnet Annex L and shall be listed as a certified B-SS in the BACnet Testing Laboratories (BTL) Product Listing.

5. BACnet Communication.

   a. Each controller residing on the ethernet data link shall capable of providing BACnet/SC capability as described in the above Communication Section.

   b. Each BC shall reside on or be connected to a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol using BACnet/IP or BACnet/SC.

   c. BACnet routing shall be performed by BCs or other BACnet device routers as necessary to connect BCs to networks of AACs and ASCs.

   d. Each AAC shall reside on a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol using BACnet/IP or BACnet/SC, or it shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.

   e. Each ASC shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.

   f. Each SA shall reside on a BACnet network using the ARCNET or MS/TP Data Link/Physical layer protocol.

   g. Each SS shall reside on a BACnet network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol with BACnet/IP addressing, or it shall reside on a BACnet network using ARCNET or MS/TP Data Link/Physical layer protocol.

C. Security.

1. Provide BACnet firewall capability, as defined in the BACnet standard, for controllers that are IP capable.

D. Communication.

1. Service Port. Each controller shall provide a service communication port for connection to a Portable Operator's Terminal

2. Signal Management. BC and ASC operating systems shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and to allow for central monitoring and alarms.

3. Data Sharing. Each BC and AAC shall share data as required with each networked BC and AAC.

4. Stand-Alone Operation. Each piece of equipment shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network such as outdoor air conditions, supply air or water temperature coming from source equipment, etc.

E. Environment. Controller hardware shall be suitable for anticipated ambient conditions.

1. Controllers used outdoors or in wet ambient conditions shall be mounted in waterproof enclosures and shall be rated for operation at 29°C to 60°C (20°F to 140°F).

2. Controllers used in conditioned space shall be mounted in dust-protective enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).

F. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to a field-removable modular terminal strip or to a termination card connected by a ribbon cable. Each BC and AAC shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.

G. Real-time Clock. Controller shall have a real-time clock to keep track of time in the event of a power failure for up to three (3) days.

H. Memory

1. Controller memory shall support operating system, database, and programming requirements.

2. Each controller shall use volatile memory with battery backed up memory or nonvolatile memory and shall retain BIOS and application programming in the event of power loss. System shall automatically download dynamic control parameters following power loss.

I. Immunity to Power and Noise. Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.

J. Transformer. Power supply shall be fused or current limiting and shall be rated at a minimum of 125% of controller power consumption.

3.6 INPUT AND OUTPUT INTERFACE

A. General. Hard-wire input and output points to BCs, AACs, or ASCs.

B. Protection. All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground shall cause no damage to the controller. All input and output points shall be protected from voltage up to 24 V of any duration, such that contact with this voltage will cause no controller damage.

C. Binary Inputs. Binary inputs shall allow the monitoring of ON/OFF signals from remote devices. Binary inputs shall sense dry contact closure without application of power external to the controller.

D. Pulse Accumulation Inputs. Pulse accumulation inputs shall conform to binary input requirements and shall also accumulate up to 10 pulses per second.

E. Analog Inputs. Analog inputs shall monitor low-voltage (0–10 Vdc), current (4–20 mA), or resistance (thermistor or RTD) signals. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.

F. Binary Outputs. Binary outputs shall provide for ON/OFF operation or a pulsed low-voltage signal for pulse width modulation control. Binary outputs on Building Controllers have three-position (on-off-auto) override switches and status lights. Outputs shall be selectable for normally open or normally closed operation.

G. Analog Outputs. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0–10 Vdc or a 4–20 mA signal as required to properly control output devices. Each Building Controller analog output shall have a two-position (auto-manual) switch, a manually adjustable potentiometer, and status lights. Analog outputs shall not drift more than 0.4% of range annually.

H. Tri-State Outputs. Control three-point floating electronic actuators without feedback with tri-state outputs (two coordinated binary outputs). Tri-State outputs may be used to provide analog output control in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers.

I. Universal Inputs and Outputs. Inputs and outputs that can be designated as either binary or analog in software shall conform to the provisions of this section that are appropriate for their designated use.

J. Operator Displays. Provide a 4", 7", or 10" operator display as noted on noted on drawings for each controller. Operator displays shall be as follows:

1. Physical Display. The display shall be a fully customizable capacitive multi-touch color display unit with the following minimum capabilities:

	4" Display	7” Display	10” Display
Display Size(diagonal)	4"	7”	10.1”
Resolution (pixels)	480 x 272	1024 x 600	1280 x 800
Brightness (cd/m2)	400	320	350
Contrast Ratio	1000:1	1000:1	800:1

2. Power. Display shall be powered by 24Vdc power

3. Maximum Colors: The display shall provide 8 bit capability for 16.7 million colors

4. Touch Screen: The screen shall be a capacitive multi-touch screen using Projected Capacitive Touch (PCAP) technology.

5. Environmental: The display shall operate in conditions of -4° to 140°F with a front IP65 water and dustproof rating and a rear IP20 water and dustproof rating.

6. Communication: The following communication ports shall be provided:

   a. Ethernet LAN port

   b. Serial Port

   c. USB Port

   d. USB OTG Port

7. System/Memory: The display shall use the Android operating system and shall have a dual core processor, 1GB LPDDR3 RAM system memory, 8GB on-board eMMC flash memory, 365-day real time clock/calendar with time and date maintained for a minimum of 72 hours after loss of power (at room temperature).

8. User Interface: Display shall provide the following user interface capabilities:

   a. Multi-level password protection for security

   b. Access virtually any point in the controller

   c. View trends

   d. View and edit BACnet time schedules

   e. Change setpoints

K. Communicating Actuators. Controller shall be capable of using hardwired actuators or an option of using communicating actuators connected to a dedicated actuator network port. The communicating actuator network shall be capable of the following:

1. The controller shall be able to communicate the actuator position command through the actuator network.

2. The actuator shall be to provide the actuator feedback position to the controller through the actuator network.

L. Communicating Sensors. Controller shall be capable of using hardwired sensors or an option of using communicating sensors connected to a dedicated sensor network port. The dedicated sensor network shall be capable of monitoring the following communicating sensors:

1. Temperature

2. Humidity

3. CO2

4. VOC

5. Occupancy

6. Motion

3.7 POWER SUPPLIES AND LINE FILTERING

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

1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.

a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.

b. Line voltage units shall be UL recognized and CSA listed.

B. Power Line Filtering.

1. Provide internal or external transient voltage and surge suppression for workstations and controllers. Surge protection shall have:

a. Dielectric strength of 1000 V minimum

b. Response time of 10 nanoseconds or less

c. Transverse mode noise attenuation of 65 dB or greater

d. Common mode noise attenuation of 150 dB or greater at 40–100 Hz

3.8 LOCAL CONTROL PANELS.

A. All indoor control cabinets shall be fully enclosed NEMA 1 construction with (hinged door) key-lock latch and removable subpanels. A single key shall be common to all field panels and subpanels.

B. Interconnections between internal and face-mounted devices shall be prewired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600 volt service, individually identified per control/ interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.

C. Provide ON/OFF power switch with overcurrent protection for control power sources to each local panel.

3.9 WIRING AND RACEWAYS

A. General. Provide copper wiring, plenum cable, and raceways as specified in applicable sections of Division 26.

B. Insulated wire shall use copper conductors and shall be UL listed for 90°C (200°F) minimum service.

PART 4 - EXECUTION

4.1 EXAMINATION

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

B. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started.

C. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and the contractor’s work and the plans and the work of others—the contractor shall report these discrepancies to the engineer and shall obtain written instructions for any changes necessary to accommodate the contractor’s work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the contractor to report such discrepancies shall be made by—and at the expense of—this contractor

4.2 PROTECTION

A. The contractor shall protect all work and material from damage by his/her work or employees and shall be liable for all damage thus caused.

B. The contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The contractor shall protect any material that is not immediately installed. The contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

4.3 COORDINATION

A. Site.

1. Where the mechanical work will be installed in close proximity to, or will interfere with, work of other trades, the contractor shall assist in working out space conditions to make a satisfactory adjustment. If the contractor installs his/her work before coordinating with other trades, so as to cause any interference with work of other trades, the contractor shall make the necessary changes in his/her work to correct the condition without extra charge.

2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.

B. Test and Balance.

1. The contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.

2. The contractor shall provide training in the use of these tools. This training will be planned for a minimum of 4 hours.

3. In addition, the contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.

4. The tools used during the test and balance process will be returned at the completion of the testing and balancing.

C. Life Safety.

1. Duct smoke detectors required for air handler shutdown are provided under Division 28. Interlock smoke detectors to air handlers for shutdown as specified in sequences of operation.

2. Smoke dampers and actuators required for duct smoke isolation are provided under Division 23. Interlock smoke dampers to air handlers as specified in sequences of operation.

3. Fire and smoke dampers and actuators required for fire-rated walls are provided under Division 23. Fire and smoke damper control is provided under Division 28.

D. Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the contractor as follows:.

1. All communication media and equipment shall be provided as specified in Section 23 09 23 Article 2.2 (Communication).

2. Each supplier of a controls product is responsible for the configuration, programming, start up, and testing of that product to meet the sequences of operation described in Section 23 09 93

3. The contractor shall coordinate and resolve any incompatibility issues that arise between control products provided under this section and those provided under other sections or divisions of this specification.

4. The contractor is responsible for providing all controls described in the contract documents regardless of where within the contract documents these controls are described

5. The contractor is responsible for the interface of control products provided by multiple suppliers regardless of where this interface is described within the contract documents.

4.4 GENERAL WORKMANSHIP

A. Install equipment, piping, and wiring/raceway parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.

B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

C. Install equipment in readily accessible locations as defined by Chapter 1 Article 100 Part A of the National Electrical Code (NEC).

D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.

E. All equipment, installation, and wiring shall comply with industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

4.5 FIELD QUALITY CONTROL

A. All work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances as identified in Section 23 09 23 Article 1.8 (Codes and Standards).

B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship.

C. Contractor shall have work inspection by local and/or state authorities having jurisdiction over the work.

4.6 WIRING

A. All control and interlock wiring shall comply with national and local electrical codes, and Division 26 of this specification. Where the requirements of this section differ from Division 26, the requirements of this section shall take precedence.

B. All NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway according to NEC and Division 26 requirements.

C. All low-voltage wiring shall meet NEC Class 2 requirements. Low-voltage power circuits shall be subfused when required to meet Class 2 current limit.

D. Where NEC Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in raceway may be used provided that cables are UL listed for the intended application.

E. All wiring in mechanical, electrical, or service rooms – or where subject to mechanical damage – shall be installed in raceway at levels below 3 m (10ft).

F. Do not install Class 2 wiring in raceways containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g. relays and transformers).

G. Do not install wiring in raceway containing tubing.

H. Where Class 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it and neatly tied at 3 m (10 ft) intervals.

I. Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems.

J. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.

K. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

L. Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the contractor shall provide step-down transformers.

M. All wiring shall be installed as continuous lengths, with no splices permitted between termination points.

N. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.

O. Size of raceway and size and type of wire shall be the responsibility of the contractor in keeping with the manufacturer’s recommendations and NEC requirements, except as noted elsewhere.

P. Include one pull string in each raceway 2.5 cm (1 in.) or larger.

Q. Use color-coded conductors throughout with conductors of different colors.

R. Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.

S. Conceal all raceways except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 15 cm (6 in.) from high-temperature equipment (e.g. steam pipes or flues).

T. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.

U. Adhere to this specification's Division 26 requirements where raceway crosses building expansion joints.

V. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of vertical raceways.

W. The contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.

X. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 1 m (3 ft) in length and shall be supported at each end. Flexible metal raceway less than ½ in. electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal raceways shall be used.

Y. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (according to code). Terminations must be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.

4.7 COMMUNICATION WIRING

A. The contractor shall adhere to the items listed in the Wiring" article in Part 3 of the specification..

B. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.

C. Do not install communication wiring in raceways and enclosures containing Class 1 or other Class 2 wiring.

D. Maximum pulling, tension, and bend radius for the cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.

E. Contractor shall verify the integrity of the entire network following cable installation. Use appropriate test measures for each particular cable.

F. When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lighting arrestor shall be installed according to manufacturer's instructions.

G. All runs of communication wiring shall be unspliced length when that length is commercially available.

H. All communication wiring shall be labeled to indicate origination and destination data.

I. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

J. BACnet ARCnet or MS/TP communications wiring shall be installed in accordance with ASHRAE/ANSI Standard 135. This includes but is not limited to:

1. ARCnet

a. The network shall use shielded, twisted-pair cable with characteristic impedance between 100 nominal. Distributed capacitance between conductors shall be less than 12.5 pF per foot (41 pF per meter.)

b. The maximum length of an ARCnet segment is 610 meters (2000 ft) with AWG 22 cable.

c. The maximum number of nodes per segment shall be 32, as specified in the EIA 485 standard. Additional nodes may be accommodated by the use of repeaters.

d. An ARCnet network shall have no T connections.

2. MS/TP

a. The network shall use shielded, twisted-pair cable with characteristic impedance between 100 and 120 ohms. Distributed capacitance between conductors shall be less than 100 pF per meter (30 pF per foot.)

b. The maximum length of an MS/TP segment is 1200 meters (4000 ft) with AWG 18 cable. The use of greater distances and/or different wire gauges shall comply with the electrical specifications of EIA-485

c. The maximum number of nodes per segment shall be 32, as specified in the EIA 485 standard. Additional nodes may be accommodated by the use of repeaters.

d. An MS/TP EIA-485 network shall have no T connections.

4.8 FIBER OPTIC CABLE

A. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post-installation residual cable tension shall be within cable manufacturer's specifications.

B. All cabling and associated components shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii, as specified by cable manufacturer, shall be maintained.

4.9 INSTALLATION OF SENSORS

A. Install sensors in accordance with the manufacturer's recommendations.

B. Mount sensors rigidly and adequately for environment within which the sensor operates.

C. Room temperature sensors shall be installed on concealed junction boxes properly supported by wall framing.

D. All wires attached to sensors shall be sealed in their raceways or in the wall to stop air transmitted from other areas from affecting sensor readings.

E. Sensors used in mixing plenums and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner vertically across the duct. Each bend shall be supported with a capillary clip.

F. Low-limit sensors used in mixing plenums shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip. Provide 3 m (1 ft) of sensing element for each 1 m2 (1 ft2) of coil area.

G. Do not install temperature sensors within the vapor plume of a humidifier. If installing a sensor downstream of a humidifier, install it at least 3 m (10 ft) downstream.

H. All pipe-mounted temperature sensors shall be installed in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.

I. Install outdoor air temperature sensors on north wall, complete with sun shield at designated location.

J. Differential Air Static Pressure.

1. Supply Duct Static Pressure. Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the high-pressure tap tubing of the corresponding building static pressure sensor (if applicable) or to the location of the duct high-pressure tap and leave open to the plenum.

2. Return Duct Static Pressure. Pipe high-pressure tap to duct using a pitot tube. Pipe the low-pressure port to a tee in the low-pressure tap tubing of the corresponding building static pressure sensor.

3. Building Static Pressure. Pipe the low-pressure port of the pressure sensor to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe the high-pressure port to a location behind a thermostat cover.

4. The piping to the pressure ports on all pressure transducers shall contain a capped test port located adjacent to the transducer.

5. All pressure transducers, other than those controlling VAV boxes, shall be located in field device panels, not on the equipment monitored or on ductwork. Mount transducers in a location accessible for service without use of ladders or special equipment.

6. All air and water differential pressure sensors shall have gauge tees mounted adjacent to the taps. Water gauges shall also have shut-off valves installed before the tee.

K. Smoke detectors, freezestats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.

L. Install humidity sensors for duct mounted humidifiers at least 3 m (10 ft) downstream of the humidifier. Do not install filters between the humidifier and the sensor.

4.10 FLOW SWITCH INSTALLATION

A. Use correct paddle for pipe diameter.

B. Adjust flow switch according to manufacturer's instructions.

4.11 ACTUATORS

A. General. Mount and link control damper actuators according to manufacturer's instructions.

1. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage.

2. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.

3. Provide all mounting hardware and linkages for actuator installation.

B. Electric/ Electronic

1. Dampers: Actuators shall be direct mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5° travel available for tightening the damper seal. Actuators shall be mounted following manufacturer's recommendations.

2. Valves: Actuators shall be connected to valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following the actuator manufacturer's recommendations.

4.12 WARNING LABELS

A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the control system.

1. Labels shall use white lettering (12-point type or larger) on a red background.

2. Warning labels shall read as follows.

a. C A U T I O N: This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing.

B. Permanent warning labels shall be affixed to all motor starters and control panels that are connected to multiple power sources utilizing separate disconnects.

1. Labels shall use white lettering (12-point type or larger) on a red background.

2. Warning labels shall read as follows.

a. C A U T I O N: This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.

4.13 IDENTIFICATION OF HARDWARE AND WIRING

A. All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 5 cm (2 in.) of termination with control system address or termination number.

B. All pneumatic tubing shall be labeled at each end within 5 cm (2 in.) of termination with a descriptive identifier.

C. Permanently label or code each point of field terminal strips to show the instrument or item served.

D. Identify control panels with minimum 1 cm (½ in.) letters on laminated plastic nameplates.

E. Identify all other control components with permanent labels. All plug-in components shall be labeled such that removal of the component does not remove the label.

F. Identify room sensors related to terminal boxes or valves with nameplates.

G. Manufacturers' nameplates and UL or CSA labels shall be visible and legible after equipment is installed.

H. Identifiers shall match record documents.

4.14 CONTROLLERS

A. Provide a separate controller for each AHU or other HVAC system. A DDC controller may control more than one system provided that all points associated with the system are assigned to the same DDC controller. Points used for control loop reset, such as outside air or space temperature, are exempt from this requirement.

B. Building Controllers and Custom Application Controllers shall be selected to provide the required I/O point capacity required to monitor all of the hardware points listed in sequences of operations.

4.15 PROGRAMMING

A. Provide sufficient internal memory for the specified sequences of operation and trend logging

B. Point Naming. Coordinate with owner for point naming conventions. Name points as shown on the equipment points list provided with each sequence of operation or as directed by owner. If character limitations or space restrictions make it advisable to shorten the name, abbreviations as coordinated with owner may be used. Where multiple points with the same name reside in the same controller, each point name may be customized with its associated Program Object number. For example, “Zone Temp 1” for Zone 1, “Zone Temp 2” for Zone 2.

C. Software Programming.

1. Provide programming for the system and adhere to the sequences of operation provided. All other system programming necessary for the operation of the system, but not specified in this document, also shall be provided by the contractor. Imbed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequences of operation. Use the appropriate technique based on the following programming types:

a. Text-based:

1) Must provide actions for all possible situations

2) Must be modular and structured

3) Must be commented

b. Graphic-based:

1) Must provide actions for all possible situations

2) Must be documented

c. Parameter-based:

1) Must provide actions for all possible situations

2) Must be documented.

D. Operator Interface.

1. Standard Graphics. Provide graphics for all mechanical systems and floor plans of the building. This includes each chilled water system, hot water system, chiller, boiler, air handler, and all terminal equipment. Point information on the graphic displays shall dynamically update. Show on each graphic all input and output points for the system. Also show relevant calculated points such as setpoints. As a minimum, show on each equipment graphic the input and output points and relevant calculated points as indicated on the applicable Points List or sequence of operations.

2. The contractor shall provide all the labor necessary to install, initialize, start up, and troubleshoot all operator interface software and its functions as described in this section. This includes any operating system software, the operator interface database, and any third-party software installation and integration required for successful operation of the operator interface.

4.16 CONTROL SYSTEM CHECKOUT AND TESTING

A. Startup Testing. All testing listed in this article shall be performed by the contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the owner's representative is notified of the system demonstration

1. The contractor shall furnish all labor and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this specification.

2. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.

3. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures according to manufacturers' recommendations.

4. Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.

5. Verify that all analog output devices (I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. The contractor shall check all control valves and automatic dampers to ensure proper action and closure. The contractor shall make any necessary adjustments to valve stem and damper blade travel.

6. Verify that the system operation adheres to the sequences of operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops.

7. Alarms and Interlocks:

a. Check each alarm separately by including an appropriate signal at a value that will trip the alarm.

b. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.

c. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

4.17 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Demonstration.

1. Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed his/her own tests.

2. The tests described in this section are to be performed in addition to the tests that the contractor performs as a necessary part of the installation, start-up, and debugging process and as specified in the “Control System Checkout and Testing” article in Part 3 of this specification. The engineer will be present to observe and review these tests. The engineer shall be notified at least 10 days in advance of the start of the testing procedures.

3. The demonstration process shall follow that approved in Part 1, “Submittals.” The approved checklists and forms shall be completed for all systems as part of the demonstration.

4. The contractor shall provide at least two persons equipped with two-way communication and shall demonstrate actual field operation of each control and sensing point for all modes of operation including day, night, occupied, unoccupied, fire/smoke alarm, seasonal changeover, and power failure modes. The purpose is to demonstrate the calibration, response, and action of every point and system. Any test equipment required to prove the proper operation shall be provided by and operated by the contractor.

5. As each control input and output is checked, a log shall be completed showing the date, technician’s initials, and any corrective action taken or needed.

6. Demonstrate compliance with Part 1, “System Performance.”

7. Demonstrate compliance with sequences of operation through all modes of operation.

8. Demonstrate complete operation of operator interface.

9. Additionally, the following items shall be demonstrated:

a. DDC loop response. The contractor shall supply trend data output in a graphical form showing the step response of each DDC loop. The test shall show the loop's response to a change in set point, which represents a change of actuator position of at least 25% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the set point, actuator position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by the Contractor.

b. Demand limiting. The contractor shall supply a trend data output showing the action of the demand limiting algorithm. The data shall document the action on a minute-by-minute basis over at least a 30-minute period. Included in the trend shall be building kW, demand limiting set point, and the status of sheddable equipment outputs.

c. Optimum start/stop. The contractor shall supply a trend data output showing the capability of the algorithm. The change-of-value or change-of-state trends shall include the output status of all optimally started and stopped equipment, as well as temperature sensor inputs of affected areas.

d. Interface to the building fire alarm system.

e. Operational logs for each system that indicate all set points, operating points, valve positions, mode, and equipment status shall be submitted to the architect/engineer. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and disk formats.

10. Any tests that fail to demonstrate the operation of the system shall be repeated at a later date. The contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests

B. Acceptance.

1. All tests described in this specification shall have been performed to the satisfaction of both the engineer and owner prior to the acceptance of the control system as meeting the requirements of completion. Any tests that cannot be performed due to circumstances beyond the control of the contractor may be exempt from the completion requirements if stated as such in writing by the engineer. Such tests shall then be performed as part of the warranty.

2. The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved as required in Part 1, "Submittals."

4.18 CLEANING

A. The contractor shall clean up all debris resulting from his/her activities daily. The contractor shall remove all cartons, containers, crates, etc., under his/her control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.

B. At the completion of work in any area, the contractor shall clean all work, equipment, etc., keeping it free from dust, dirt, and debris, etc.

C. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

4.19 TRAINING

A. Provide training for a designated staff of Owner's representatives. Training shall be provided via self-paced training, web-based or computer-based training, classroom training, or a combination of training methods.

B. Training shall enable students to accomplish the following objectives.

1. Day-to-day Operators:

a. Proficiently operate the system

b. Understand control system architecture and configuration

c. Understand DDC system components

d. Understand system operation, including DDC system control and optimizing routines (algorithms)

e. Operate the workstation and peripherals

f. Log on and off the system

g. Access graphics, point reports, and logs

h. Adjust and change system set points, time schedules, and holiday schedules

i. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals

j. Understand system drawings and Operation and Maintenance manual

k. Understand the job layout and location of control components

l. Access data from DDC controllers and ASCs

m. Operate portable operator's terminals

2. Advanced Operators:

a. Make and change graphics on the workstation

b. Create, delete, and modify alarms, including annunciation and routing of these

c. Create, delete, and modify point trend logs and graph or print these both on an ad-hoc basis and at user-definable time intervals

d. Create, delete, and modify reports

e. Add, remove, and modify system's physical points

f. Create, modify, and delete programming

g. Add panels when required

h. Add operator interface stations

i. Create, delete, and modify system displays, both graphical and others

j. Perform DDC system field checkout procedures

k. Perform DDC controller unit operation and maintenance procedures

l. Perform workstation and peripheral operation and maintenance procedures

m. Perform DDC system diagnostic procedures

n. Configure hardware including PC boards, switches, communication, and I/O points

o. Maintain, calibrate, troubleshoot, diagnose, and repair hardware

p. Adjust, calibrate, and replace system components

3. System Managers/Administrators:

a. Maintain software and prepare backups

b. Interface with job-specific, third-party operator software

c. Add new users and understand password security procedures

C. Organize the training into sessions or modules for the three levels of operators listed above. (Day-to-Day Operators, Advanced Operators, System Managers and Administrators). Students will receive one or more of the training packages, depending on knowledge level required.

D. Provide course outline and materials according to the "Submittals" article in Part 1 of this specification. Provide one copy of training material per student.

E. The instructor(s) shall be factory-trained and experienced in presenting this material.

F. Classroom training shall be done using a network of working controllers representative of installed hardware.

4.20 SEQUENCES OF OPERATION

A. See Section 23 Sequences of Operation.

4.21 CONTROL VALVE INSTALLATION

A. Valve submittals shall be coordinated for type, quantity, size, and piping configuration to ensure compatibility with pipe design.

B. Slip-stem control valves shall be installed so that the stem position is not more than 60 degrees from the vertical up position. Ball type control valves shall be installed with the stem in the horizontal position.

C. Valves shall be installed in accordance with the manufacturer's recommendations.

D. Control valves shall be installed so that they are accessible and serviceable and so that actuators may be serviced and removed without interference from structure or other pipes and/or equipment.

E. Isolation valves shall be installed so that the control valve body may be serviced without draining the supply/return side piping system. Unions shall be installed at all connections to screw-type control valves.

F. Provide tags for all control valves indicating service and number. Tags shall be brass, 1.5 inch in diameter, with ¼ inch high letters. Securely fasten with chain and hook. Match identification numbers as shown on approved controls shop drawings.

4.22 CONTROL DAMPER INSTALLATION

A. Damper submittals shall be coordinated for type, quantity, and size to ensure compatibility with sheet metal design.

B. Duct openings shall be free of any obstruction or irregularities that might interfere with blade or linkage rotation or actuator mounting. Duct openings shall measure ¼ in. larger than damper dimensions and shall be square, straight, and level.

C. Individual damper sections, as well as entire multiple section assemblies, must be completely square and free from racking, twisting, or bending. Measure diagonally from upper corners to opposite lower corners of each damper section. Both dimensions must be within 0.3 cm (1/8 in.) of each other.

D. Follow the manufacturer's instructions for field installation of control dampers. Unless specifically designed for vertical blade application, dampers must be mounted with blade axis horizontal.

E. Install extended shaft or jackshaft according to manufacturer's instructions. (Typically, a sticker on the damper face shows recommended extended shaft location. Attach shaft on labeled side of damper to that blade.)

F. Damper blades, axles, and linkage must operate without binding. Before system operation, cycle damper after installation to ensure proper operation. On multiple section assemblies, all sections must open and close simultaneously.

G. Provide a visible and accessible indication of damper position on the drive shaft end.

H. Support ductwork in area of damper when required to prevent sagging due to damper weight.

I. After installation of low-leakage dampers with seals, caulk between frame and duct or opening to prevent leakage around perimeter of damper.

4.23 SMOKE DAMPER INSTALLATION

A. The contractor shall coordinate all smoke and smoke/fire damper installation, wiring, and checkout to ensure that these dampers function properly and that they respond to the proper fire alarm system general, zone, and/or detector trips. The contractor shall immediately report any discrepancies to the engineer no less than two weeks prior to inspection by the code authority having jurisdiction.

B. Provide complete submittal data to controls system subcontractor for coordination of duct smoke detector interface to HVAC systems.

4.24 DUCT SMOKE DETECTION

A. Submit data for coordination of duct smoke detector interface to HVAC systems as required in Part 1, “Submittals.”

B. This Contractor shall provide a dry-contact alarm output in the same room as the HVAC equipment to be controlled.

4.25 PACKAGED EQUIPMENT CONTROLS

A. General. The electronic controls packaged with any equipment furnished under this contract shall communicate with the building direct digital control (DDC) system. The DDC system shall communicate with these controls to read the information and change the control setpoints as shown in the points list, sequences of operation, and control schematics. The information to be communicated between the DDC system and these controls shall be in the standard object format as defined in ANSI/ASHRAE Standard 135 (BACnet). Controllers shall communicate with other BACnet objects on the internetwork using the Read (Execute) Property service as defined in Clause 15.5 of Standard 135.

B. Distributed Processing. The controller shall be capable of stand-alone operation and shall continue to provide control functions if the network connection is lost.

C. I/O Capacity. The controller shall contain sufficient I/ O capacity to control the target system.

D. The Controller shall have a physical connection for a laptop computer or a portable operator’s tool.

E. Environment. The hardware shall be suitable for the anticipated ambient conditions.

1. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at -29°C to 60°C (-20°F to 140°F).

2. Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 50°C (32°F to 120°F).

F. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field removable, modular terminal strips or to a termination card connected by a ribbon cable.

G. Memory. The Controller shall maintain all BIOS and programming information in the event of a power loss for at least 30 days.

H. Power. Controller shall be able to operate at 90% to 110% of nominal voltage rating .

I. Transformer. Power supply for the Controller must be rated at minimum of 125% of ASC power consumption and shall be fused or current limiting type.

4.26 START-UP AND CHECKOUT PROCEDURES

A. Start up, check out, and test all hardware and software and verify communication between all components.

1. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.

2. Verify that all analog and binary input/output points read properly.

3. Verify alarms and interlocks.

4. Verify operation of the integrated system.

END OF SECTION 230900

4.0 Project Schedule

4.1 The Bid Package will be available to Bidders on July 14th, 2025.

4.2 Original reference drawings are available from the Owner upon request.

4.3 Bid Meeting will be at 10:00am, on August 5th, 2025, at Swonder Ice Arena.

4.4 Sealed Bids are due September 3rd, 2025.

4.5 The Contract will be awarded to the Successful Bidder by September 17th, 2025.

4.6 The Successful Bidder will begin work TBD.

4.7 Contractor is to have 5 day work window, available Monday – Friday 7am-7pm.

Any reference made to any manufacturer or brand name is not to be construed as a limiting factor in the bid, but is meant to show the minimum scope and quality of the product to be quoted. Contractor can submit approved equals for items that vary from those requested.

Note – If the project cost exceeds budget, project may award by individual location(s) or rejected in total.

A. The Contractor is to provide to the City of Evansville a copy of its "Random Drug Testing Program and Contractor's Licenses" as provided for in Chapter 3.95 of the City of Evansville Municipal Code if the quote is $10,000 or more or if under $10,000 the contractor is to provide the City of Evansville a copy of its "Contractor's Licenses and Random Drug Testing Program" which is to include at a minimum random drug testing of at least the five (5) drug panel tests as provided for in Chapter 3.95 (a copy of which is attached) in Title 3 of the City of Evansville Municipal Code at the time of the quote.

B. A coverage limit of not less than General Aggregate: $5,000,000, Products & Completed Operations Aggregate, Not Less Than $5,000,000; Personal & Advertising Injury, Not Less Than $1,000,000; Each Occurrence Not Less Than $750,000; Fire Damage (Any one fire) Not less Than $50,000; Medical Expense (Any one person), Not Less Than $5,000.

   The evidence of insurance coverage shall be endorsed and provided to City of Evansville, prior to start of the project showing City of Evansville as additional insured.

   Other insurance requirements are listed in Section XI under "Scope of Services."

C. **Notice to Proceed & Schedule of Work**: All work is to be completed 90 calendar days from Notice to Proceed. Contractor shall notify Andrea' Lord, Swonder Ice Arena Assistant Facility manager (email: alord@evansville.in.gov or phone: (812)436-5712), prior to commencing work and shall keep Andrea' abreast with work schedule and location of work pertaining to this project.

NOTE: If work is not completed in the time schedule set above, a $100 per day penalty in liquidated damages will be assessed against the Contractor for each day work does not meet the guideline as specified unless a mutual resolution is met by both parties due to an unforeseen incident involving this bid.

D. **Final Inspection & Invoicing**: Upon completion of the work, Contractor shall request Andrea' Lord, Swonder Ice Arena Assistant Facility Manager and email her at alord@evansville.in.gov schedule an inspection. After inspection, a list of items needing additional work or correction will be provided to the Contractor. Upon completion of these items, the Contractor shall request another inspection. This process will be repeated until all work is deemed acceptable to the City. The last inspection shall constitute the final inspection and acceptance of the work by the City (the "Final Inspection"). Until the Final Inspection, no part of the work will be accepted. Only upon Final Inspection may the Contractor submit an invoice for the contract amount as modified by any written change orders.

E. **Responsibility of Damage:** Pavement, sidewalks, vehicles, yard ruts, office equipment, building structure including walls, traffic signal equipment, traffic signs, pedestrians, vehicular, other traffic, etc. shall be protected against damage or disfigurement from material or equipment used in the removal and/or installation of the equipment. Contractor shall be responsible for all damages accordingly. Contractor shall be responsible to keep working area clean of debris.

WARRANTY REQUIREMENTS

A. Warranty – 1 year Parts and Labor/ 5 year Compressor/ 25 year SS Heat Exchanger.

I. QUALIFICATIONS

A. **Minimum Qualifications**

1. Contractor and their employees must present themselves in a professional manner at all times. Shirts are to be worn at all times. Offensive clothing and language will not be tolerated. Note: **This is at the sole discretion Swonder Ice Arena Assistant Facility Manager, Andrea' Lord (812)436-5712.**
2. The use of alcohol or illegal drugs will not be tolerated.

.

B. **Statement of Experience**

1. Contractor must submit three (3) local letters of references.
2. Contractor must submit list of manpower to be utilized.
3. Contractor must submit length business has been in existence doing this type of work.

C. **Non-Compliance**

1. The Contractor also agrees that should the Contractor fail to comply with the terms of the contract, Contractor will be given four (4) days to bring in such non-compliance to compliance. If Contractor fails to correct such non-compliance, the City may do one or more of the following:
   a. Terminate the contract and pay the Contractor only to the date of termination less any amounts owed to the City by the Contractor.
   b. Use its own workers or hire another contractor to remedy the breach and withhold from payments due the Contractor the cost of such corrective measures.
   c. Any other remedy allowed at law or equity.

II. INVOICE SUBMISSION

A. Submit an invoice upon approval of the work. The invoice will then be processed for payment.
B. The invoice submitted for payment must include the following:
    1. Name “Swonder Ice Arena” on the invoice(s).
    2. All invoices must be itemized. Must have company name, address, phone number.
    3. Invoices must have an invoice number and not duplicate any others.

III. INSURANCE

A. The Contractor shall procure and keep in force during the term of the contract general liability insurance that shall protect it and the Owner (as an additional insured) and any subcontractors performing work under the contract against claims for damage for personal injury, occupational sickness or disease, including accidental death, as well as the claims for property damage, which may arise from operations under the contract, whether such operations be by Contractor or by any subcontractor(s), or by any one directly or indirectly employed by either of them, in the amount of at least ($1,000,000) one million dollars combined single limit for each occurrence. Contractor shall carry worker’s compensation insurance coverage in amounts required by Indiana law for all of its employees who perform work under the contract.
B. The City of Evansville shall be named as additional insured on such general liability insurance. Certificates of insurance must be presented to the Board of Public Works or its designated representative (Purchasing Department) prior to the commencement of the contract.

IV. DAMAGE TO PREMISES

A. If the property or contents is damaged in any way whatsoever by reason of any act or omission of the Contractor or its employees, the Contractor shall immediately repair at its own cost and expense the building, structure, wall, fence, equipment, etc., as damaged.
B. Upon failure of the Contractor to make such repairs, the Board of Park Commissioners and/or the City of Evansville may repair such damage at the cost and expense of the Contractor and shall have the right to terminate the contract.

Tabulation Pages

DATE:

The Board of Parks Commissioners / City of Evansville invite your bid for the following item:

For
SWONDER ROOFTOP UNIT #1, #4, #5, #6, #7, #8, #9 & #10 REPLACEMENT

To be opened at 12:00 pm (CDT) **on September 3rd, 2025** in Room 301 of the Civic Center Complex.

The undersigned proposes to furnish and deliver, in accordance with the requirements of the Instructions to Vendor's and the Specifications July 14, **2025** prepared by Park's Department.

Please be advised that any alterations, changes in bid format, etc., will make it difficult to evaluate bids and may lead to confusion. All items should be quoted in the units, quantities, and units of measurements specified. Do not submit alternate bid unless requested. The City of Evansville and the Board of Public Works shall reserve the right to reject any or all bids or any part thereof.

QUOTATIONS

1. All prices F.O.B. to City of Evansville, 47708. Yes___No ____

INDEMNIFICATION

Bidder will indemnify and hold harmless the City of Evansville and Vanderburgh County in accordance with the provisions contained herein? Yes___No ____

BIDDER QUALIFICATION AND EXPERIENCE

1. Bidder has included three (3) references? Yes___No ____

2. Bidder possesses necessary occupational license(s)? Yes___No ____

_____

Printed Name of Person Giving Quote

_____ Date:_____

BID SHEET

[PLEASE MAKE THIS PAGE 1 OF YOUR SUBMISSION]

1. **Replacement of Rooftop Unit #1, #4, #5, #6, #7, #8, #9 & #10 at Swonder Ice Arena**

$_____

Written: _____

ADD ANY ADDITIONAL OPTIONS HERE

VENDOR'S CHECKLIST:

In order to be accepted as a valid bid, the following items MUST be included with your bid, along with any other information requested in the specifications.

1. **Tabulation Page** _____
2. **Vendor Checklist** _____
3. **Non-Collusion Affidavit** _____
4. **Equal Employment Opportunity Statement** _____
5. **Indiana Legal Employment Declaration/E-Verify** _____
6. **Conflict of Interest Disclosure** _____
7. **Contractors Bid for Public Work – Form** _____
8. **Responsible Bidder certification** _____
   (See General Requirements, Item F)
9. **Contractor Acknowledgement** _____
10. **Minimum Qualifications** _____
    (See Specifications A Paragraph 9. Qualifications, Section A. Minimum Qualifications)
11. **Statement of Experience** _____
    (See Specifications A Paragraph 9 Section B. Statement of Experience)
12. **List of References** _____
    (See Form 96 Section1 Part 2 (Page I-3))
13. **Bid Bond** _____

NON-COLLUSION AFFIDAVIT

The undersigned bidder or agent, being duly sworn on oath, says that they have not, nor has any other member, representative, or agent of the firm, company, corporation or partnership represented by them, entered into any combination, collusion or agreement with any person relative to the price to be quote by anyone at such letting nor to prevent any person from quoting nor to induce anyone to refrain from quoting, and that this quote is made without reference to any other quote and without an agreement, understanding or combination with any other person in reference to such quoting. Bidder further says that no person or persons, firms, or corporation has, has or will receive directly or indirectly, any rebate, fee, gift, commission or thing of value on account of such sale.

AUTHORIZED SIGNATURE	**DATE**
NAME & TITLE (PLEASE PRINT)	**TELEPHONE**
COMPANY NAME	**FAX**
ADDRESS (STREET)	**CITY, STATE, ZIP CODE**

Subscribed and sworn to before me this _____day of _____, 2025.

My Commission Expires:_____ _____

Notary Public

County of Residence: _____

CONTRACTOR'S STATEMENT ON SUB-CONTRACTORS

1. There are NO sub-Contractors associated with this IFB.

Authorized Signee:_____

Printed Name: _____

Title: Date: _____

For (Company): _____

OR

2. Listed below are sub-Contractors associated with this IFB. Additional sheets are attached as required. I_____have also attached appropriate Disadvantage Business Certifications.

Name of Company: _____

Address:_____

Contact Person: _____

Telephone #: _____

E-mail: _____

Name of Company: _____

Address: Contact Person: _____

Telephone #: _____

E-mail: _____

EQUAL EMPLOYMENT OPPORTUNITY

During the performance of the contract, the Contractor agrees as follows:

1. The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, national origin political affiliation or belief, age or disability. The Contractor will take affirmative action to insure that applicants are employed, and that employees are treated during employment, without regard to race, color, religion, sex, national origin, political affiliation or belief, age, or disability. Such action shall include but not be limited to the following: employment, upgrading, demotion, or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notice setting forth the provisions of the nondiscrimination clause.

2. The Contractor agrees that all services, facilities, activities and programs provided as part of the contract will meet the requirements of the Americans with Disabilities Act and the rules and regulations promulgated thereunder.

3. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor; state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, political affiliation or belief, age or disability.

4. The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided, advertising, the labor union or workers' representative of the Contractor's commitments under the Equal Employment Opportunity Section of the contract and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

5. In the event of the Contractor's noncompliance with the nondiscrimination clauses of the contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further City/County contract.

Vendor Representative (Please Print)	Signed
Vendor Name	Telephone
Vendor Address	Date

-DO NOT SUBSTITUTE THIS PAGE-

INDIANA LEGAL EMPLOYMENT DECLARATION

The State of Indiana has enacted a law (I.C. 22-5-1.7) requiring all state agencies and political subdivisions request verification from their contractors that their employees are legally eligible to work in the United States. This Declaration serves as notice that all Contractors doing business with the City of Evansville must, as a term of their contract:

1. Enroll in and verify the work eligibility status of newly hired employees of the contractor through the E-Verify programs (but is not required to do this if the E-Verify program no longer exists); and
2. Verify, by signature below, that the Contractor does not knowingly employ unauthorized aliens.

I, _____, a duly authorized agent of _____(name of Company), declare under penalties of perjury that _____(name of Company) does not employ unauthorized aliens to the best of its knowledge and belief.

_____

(Name of Company)

By:_____

(Authorized Representative of Company)

Subscribed and sworn to before me on this _____day of _____, 2025.

My Commission Expires: _____

County of Residence: _____

_____

Notary Public – Signature

_____

Notary Public – Printed Name

For instructions and electronic registration for E-verify, please see:

https://e-verify.uscis.gov/enroll/StartPage.aspx?JS=YES

-DO NOT SUBSTITUTE THIS PAGE-

CONFLICT OF INTEREST / FAMILIAL DISCLOSURE FORM

Project: _____

ALL BIDDERS must complete this Conflict of Interest Familial Disclosure Form and must attach the completed form to the bid.

As the bidder, I affirm that no principal, representative, agent, employee, contractor or potential subcontractors, or other acting on behalf of or legally capable of acting on the behalf of the bidder (a "Bidder Party"), is currently an employee of the City of Evansville (" City"), any City department or a member of any City Board or Council; nor will any such person connected to the bidder be privy to any City information which may constitute a conflict of interest; or, if such a conflict or relationship does exist, I have disclosed the nature of the relationship or conflict below.

By the attached sworn and notarized statement we are disclosing the following familial relationship(s) that exists between a Bidder Party and any employee or member of any City Department or board.

As the bidder, I understand that completing this form and self-disclosing potential conflicts of interest does not necessarily disqualify a bidder, but aids in identifying conflicts of interests which must be addressed pursuant to I.C. 35-44.1-1 et al. Further, the City will insure that any individuals identified with a potential conflict will not be allowed to participate in the scoring or evaluation of the bid packages, to insure the integrity of the bid process.

The following is a list of individuals who may pose a potential conflict of interest as described above Please provide the name, relationship with the City and the nature of the potential conflict, or if applicable: **"**NONE" :

Signature(s): _____ **Title:** _____

Vendor/Bidder:_____

STATE OF _____)

) **SS:**

COUNTY OF _____)

BEFORE ME, a Notary Public in and for said County and State, personally appeared_____,

_____of _____, who having been duly sworn, acknowledged and affirmed that they did sign said instrument as such officer or authorized agent for and on behalf of _____, and by authority granted by such entity, that the same is their free act and deed and the free act and deed of said entity.

WITNESS my hand and notarial seal this _____day of _____, 2025.

My commission expires:

_____

My County of residence is:

_____County, State of _____

_____

Notary Public

_____

Printed Name of Notary Public

CONTRACTOR'S BID FOR PUBLIC WORK - FORM 96

State Form 52414 (R2 / 2-13) / Form 96
(Revised 2013) Prescribed by State Board
of Accounts

PART 1

(To *be completed for all bids. Please type or print)*

Date *(month, day, year):*_____

1.

Governmental Unit (Owner): City of Evansville, Indiana, by and through its Board of Public Works

County: Vanderburgh County, Indiana

Bidder (Firm):_____

Address:_____

City/State/ZIP code:_____

Telephone Number:_____

Agent of Bidder *(if applicable):*_____Pursuant to notices given, the undersigned offers to furnish labor and/or material necessary to complete the public works project of City of Evansville, Indiana, by and through its Board of Public Works, in accordance with plans and specifications prepared by Metropolitan Evansville Transit System and dated for the sum of

_____$_____

The undersigned further agrees to furnish a bond or certified check with this bid for an amount specified in the notice of the letting. If alternative bids apply, the undersigned submits a BID for each in accordance with the notice. Any addendums attached will be specifically referenced at the applicable page.

If additional units of material included in the contract are needed, the cost of units must be the same as that shown in the original contract if accepted by the governmental unit. If the bid is to be awarded on a unit basis, the itemization of the units shall be shown on a separate attachment.

The contractor and his subcontractors, if any, shall not discriminate against or intimidate any employee, or applicant for employment, to be employed in the performance of this contract, with respect to any matter directly or indirectly related to employment because of race, religion, color, sex, national origin or ancestry. Breach of this covenant may be regarded as a material breach of the contract.

CERTIFICATION OF USE OF UNITED STATES STEEL PRODUCTS

(If applicable)

I, the undersigned bidder or agent as a contractor on a public works project, understand my statutory obligation to use steel products made in the United States (I C 5-16-8-2). I hereby certify that I and all subcontractors employed by me for this project will use U.S. steel products on this project if awarded. I understand that violations hereunder may result in forfeiture of contractual payments.

_____

Name of Contractor

_____

Signature

_____

Printed Name/Title

PART II
(For projects of $150,000 or more — IC 36-1-124)

Governmental Unit: City of Evansville, Indiana, by and through its Board of Public Works

Bidder (Firm) _____

Date *(month, day, year):* _____

These statements to be submitted under oath by each bidder with and as a part of his bid. Attach additional pages for each section as needed.

SECTION I EXPERIENCE QUESTIONNAIRE

1. What public works projects has your organization completed for the period of one (1) year prior to the date of the current bid?

Contract Amount	Class of Work	Completion Date	Name and Address of Owner

2. What public works projects are now in process of construction by your organization?

Contract Amount	Class of Work	Completion Date	Name and Address of Owner

3. Have you ever failed to complete any work awarded to you? _____If so, where and why?

_____
_____
_____

4. List references from private firms for which you have performed work.

_____
_____
_____

SECTION II PLAN AND EQUIPMENT QUESTIONNAIRE

1. Explain your plan or layout for performing proposed work. (Examples could include a narrative of when you could begin work, complete the project, number of workers, etc. and any other information which you believe would enable the governmental unit to consider your bid.)

_____
_____
_____

2. Please list the names and addresses of all subcontractors (i.e. persons or firms outside your own firm who have performed part of the work) that you have used on public works projects during the past five (5) years along with a brief description of the work done by each subcontractor.

_____
_____
_____

3. If you intend to sublet any portion of the work, state the name and address of each subcontractor, equipment to be used by the subcontractor, and whether you will require a bond. However, if you are unable to currently provide a listing, please understand a listing must be provided prior to contract approval. Until the completion of the proposed project, you are under a continuing obligation to immediately notify the governmental unit in the event that you subsequently determine that you will use a subcontractor on the proposed project.

_____
_____
_____

4. What equipment do you have available to use for the proposed project? Any equipment to be used by subcontractors may also be required to be listed by the governmental unit.

_____
_____
_____

5. Have you entered into contracts or received offers for all materials which substantiate the prices used in preparing your bid? If not, please explain the rationale used which would corroborate the prices listed.

_____
_____
_____

SECTION III CONTRACTOR'S FINANCIAL STATEMENT

Attachment of bidder's financial statement is mandatory. Any bid submitted without said financial statement as required by statute shall thereby be rendered invalid. The financial statement provided hereunder to the governing body awarding the contract must be specific enough in detail so that said governing body can make a proper determination of the bidder's capability for completing the project if awarded.

The undersigned bidder or agent, being duly sworn on oath, says that he has not, nor has any other member, representative, or agent of the firm, company, corporation or partnership represented by him, entered into any combination, collusion or agreement with any person relative to the price to be bid by anyone at such letting nor to prevent any person from bidding nor to include anyone to refrain from bidding, and that this bid is made without reference to any other bid and without any agreement, understanding or combination with any other person in reference to such bidding.

He further says that no person or persons, firms, or corporation has, have or will receive directly or indirectly, any rebate, fee, gift, commission or thing of value on account of such sale.

SECTION IV OATH AND AFFIRMATION

I HEREBY AFFIRM UNDER THE PENALTIES FOR PERJURY THAT THE FACTS AND INFORMATION CONTAINED IN THE FOREGOING BID FOR PUBLIC WORKS ARE TRUE AND CORRECT.

Dated: _____

_____
(Name of Organization)

By_____

_____
(Title of Person Signing)

ACKNOWLEDGEMENT

STATE OF_____)
)ss
COUNTY OF_____)

Before me, a Notary Public, Personally appeared the above-named_____ and swore that the statements contained in the forgoing document are true and correct.

Subscribed and sworn to before me this day of_____,

Notary Public

My Commission Expires:_____

County of Residence:_____

BID OF

_____

(Contractor)

_____

_____

_____

(Address)

FOR PUBLIC WORKS PROJECTS OF

_____

_____

_____

Filed_____, _____

Action taken

_____

_____

_____

RANDOM DRUG TESTING POLICY

Following are the requirements for required random drug testing programs as provided for in Chapter 3.95 of the Evansville Municipal Code.

The Contractor, and every Sub-Contractor doing construction work on the project, shall have a random drug testing program in place at the time of submission of his quote or bid which shall, at a minimum, meet the following qualifications and criteria:

A. The Contractor shall maintain a random drug testing program, and the program shall be reduced to writing.

B. The drug testing program shall contain at least a five (5) drug panel that tests for the following drugs: amphetamines, cocaine, opiates (92000 ng/ml), PCP, and THC.

C. All the employees of the Contractor are subject to at least annual testing, and at least one-twelfth ($1/12^{th}$) of 25% of the employer's total workforce shall be selected randomly each month for testing.

D. The random drug testing program operated by the Contractor shall contain a progressive discipline component for employees who fail the drug test that meets at least the following minimum steps:
   1. The first positive test shall result in a thirty (30) day period of ineligibility for work, and upon returning to work, one (1) year of unannounced follow-up testing.
   2. A second positive test shall result in a ninety (90) day period of ineligibility for work, and upon returning to work, one (1) year of unannounced follow-up testing.
   3. A third positive test shall result in a one (1) year period of ineligibility for work, and upon returning to work, one (1) year of unannounced follow-up testing.
   4. Any subsequent positive test shall be treated the same as a third positive test.
   5. At the discretion of the employer, the discipline issued above may include more severe discipline including, but not limited to, dismissal of the employee.

E. Evidence of the Contractor's drug testing policy shall be submitted with the bid. Failure to provide evidence of the Contractor's random drug testing policy or program shall result in a rejection of the bid. Submitting false information concerning compliance with the requirements of this chapter shall result in the rejection of the bid or cancellation of the Contract if an award has been made prior to determining the information is false by the Board, Commission, or Agency. In such event, the Contractor shall be paid only for the work done prior to cancellation of the Contract.

F. This section shall be applicable only to construction contracts where the cost of the contract is more than Ten Thousand Dollars.

CONTRACTOR'S ACKNOWLEDGMENT

The undersigned Contractor certifies under the penalties of perjury, and in accordance with I.C. § 5-16-13 *et seq.* and I.C. § 22-5-1.7-11.1 *et seq.* as follows:

1. The Contractor has enrolled in and will verify the work eligibility status of all newly hired employees through the E-Verify program so long as the E-Verify program is in existence. The Contractor does not and shall not knowingly employ an unauthorized alien.

2. The Contractor shall receive a certificate from each subcontractor of any tier on the project that, at the time of certification, the subcontractor does not knowingly employ or contract with an unauthorized alien and has enrolled and is participating in the E-Verify program.

3. If the Agreement is for $10,000 or more, Contractor has established an employee drug testing program in compliance with Evansville Municipal Code 3.95.020 and has attached hereto the written plan for the program or a copy of the relevant part of the collective state bargaining agreement providing for such program.

4. If the Agreement is for $300,000 or more, Contractor has attached a current certificate of qualification issued by the State of Indiana under I.C. § 4-13.6-4 or I.C. § 8-23-10.

5. If the Agreement is for $150,000 or more, Contractor shall provide a current certification as a Responsible Bidder in compliance with Evansville Municipal Code 3.95.040. This Code includes, among other requirements, evidence that the Contractor is in compliance with I.C. § 5-16-13-12 and its requirements pertaining to participation in apprenticeship and training programs applicable to the work to be performed on the public work project.

6. The Contractor acknowledges that discrimination or intimidation of any employee hired for the performance of work under this Agreement, by Contractors and subcontractors, on account of race, religion, color, sex, national origin or ancestry is prohibited under I.C. § 5-16-6-1.

On behalf of Contractor, I hereby acknowledge and certify under the penalties of perjury that the foregoing statements are true and correct to the best of my knowledge and belief.

CONTRACTOR:

Date: _____ By: _____

_____
(Printed Name and Title)

GENERAL CONDITIONS

1. DEFINITIONS

The Contract Documents consist of the Contract, the Notice to Bidders, the Bid Proposal, the Instructions to Bidders, the General Conditions, the Special Conditions, the Special Provisions, the Project Drawings, the Standard Drawings and the Specifications. The Standard Specifications of the Indiana Department of Transportation (INDOT), Current Edition, are referenced in the Contract Documents, and are incorporated by reference.

The Contract shall consist solely of all written terms of this written agreement, entered into by and between the Owner and by the Contractor in the performance of the Work and the payment therefore and the Contract Documents. This Contract and the Contract Documents supersedes any prior agreements, written or oral, between the Owner and the Contractor.

The following terms are used in these Contract Documents, and are defined as follows:

a) Project	The entire improvement proposed by the Owner to be constructed in whole or in part pursuant to the Contract.
b) Owner	The City of Evansville, acting by and through the lawful conduct of the appropriate Board or Commission.
c) Contractor employees, workmen or	The person, persons, firms or corporations to whom the Contract is awarded by the Owner, including all agents, assignees of said Contractor.
d) SubContractor	A person, firm, or corporation other than the Contractor, who supplies labor, workmen and materials, or labor only, or work at the site of the Project at the request of the Contractor.
e) Work	All work, including materials, labor, supervision, use of tools, etc., necessary to complete the Project in full compliance with the terms of the Contract, including work performed by the Contractor and his SubContractor(s).
f) Engineer	Three I Design
g) Surety	The person, firm or corporation that has executed, as surety, the Contractor's Performance Bond, securing the Contractor's performance of the Contract.
h) Affected County	Vanderburgh County or an adjacent county.
i) E-Verify Program	An electronic verification of work authorization program of the Illegal Immigration Reform and Immigration Responsibility Act of 1996 (P.L. 104-208), Division C, Title IV, s.403(a), as amended, operated by the United States Department of Homeland Security or successor work authorization program designated by the United States Department of Homeland Security or other federal agency authorized to verify the work authorization status of newly hired employees under the Immigration Reform and Control Act of 1986 (P.L. 99-603).
j.) Local Indiana Business	A business whose principal place of business is in an Affected County; a business that pays a majority of its payroll (in dollar volume) to residents of Affected Counties; or a business that employees residents of Affected Counties as a majority of its employees.

The Owner, Contractor and Engineer are treated throughout the Contract Documents as if each were of the singular number and masculine gender. When the term Person or Persons is used, it shall be understood to include an Individual, a Firm, a Partnership, an Association, a Corporation, or other business entity.

When the terms Owner or Engineer are used, they shall be understood to mean the Owner and Engineer defined in b) and f) above, unless the wording clearly indicates another meaning.

2. INTENT OF CONTRACT DOCUMENTS

The provisions of the Contract Documents, the Specifications and the Project Drawings are complementary, and what is called for by any one shall be interpreted as being called for in all other writings, composing this Contract. The creation of the Contract Documents is to express the intentions of the parties with respect to the contract price the cost of all labor and materials, water, fuel, tools, plant, equipment, transportation and all other expense necessary for the proper execution and further to express the intent of the parties as to other issues relating to the manner by which the Work shall proceed. Words describing materials or Work which have a well-known technical or trade meaning, unless otherwise specifically defined in the Contract Documents, shall be construed in accordance with their recognized meanings.

Any Work shown on the Project Drawings and not addressed or included in the Contract Documents, or not addressed or included in the Specifications, shall be performed by the Contractor as if this Work was shown on the Project Drawings and included in the Specifications. If the Project Drawings and Specifications should be contradictory in any part, the Specifications shall govern. The Contractor shall advise the Owner in writing of any alleged omissions of Specification(s) prior to the initiation of any Work shown on the Project Drawings or called for in the Contract Documents.

3. CONTRACT DRAWINGS AND SPECIFICATIONS

All Work shall be executed in strict conformity with the Project Drawings and Specifications, and the Contractor shall do no Work without proper Project Drawings and Instructions. The Contractor shall be liable for all claims and costs arising from failure to perform Work without proper Project Drawings and Instructions.

Unless otherwise provided in the Special Conditions, the Owner will furnish to the Contractor, free of charge, all copies of the Project Drawings and Specifications reasonably necessary to carry out the Work.

Figured dimension on the Project Drawings shall be taken as correct, but shall be checked by the Contractor before starting construction. Any errors, omissions, or discrepancies shall be brought to the attention of the Engineer, and his decision thereon shall be final Correction of errors or omissions on the Project Drawings or in the Specifications may be made by the Engineer when such correction can reasonably be considered necessary for the proper execution and completion of the Work. (See Section 23 "Changes in the Work")

All notes on the Project Drawings shall be followed. The Owner or Engineer shall furnish additional instructions, by means of Project Drawings or otherwise, necessary for the proper execution of the Work. All such Project Drawings and Instructions shall be consistent with the Contract Documents.

The Contractor represents and warrants that he has completely familiarized himself with and understands the terms and provisions of the Contract Documents, Project Drawings and Specifications prior to performing any Work.

4. OWNERSHIP OF DRAWINGS

All Project Drawings, Specifications and copies thereof furnished by the Owner or Engineer are the property of the Owner and are not to be used on any other Project. All Project Drawings and Specifications with the exception of one signed set for each party to the Contract, are to be returned to the Owner on completion of the Project.

5. CONTRACT SECURITY

Contractors responding to the bid are required to submit a **Bid Bond** or a Certified Check pursuant to the provisions of I.C. 36-1-12-4.5, in the amount of five percent (5%) of the total bid proposal as a guarantee that all provisions of the specifications shall be met. The bond or certified check shall be made payable to the City of Evansville. All bonds or checks of unsuccessful bidders will be returned to the unsuccessful Contractor(s) after award of purchase by the Owner and to the successful Contractor(s) after the Performance Bond has been received and accepted.

The successful Contractor shall be required to execute a **Payment Bond** pursuant to the provisions of I.C. 36-1-12-13.5 for the benefit of the Owner, the subContractors, material suppliers and other service providers in an amount equal to the contract price with such sureties as shall be acceptable to Owner, prior to the beginning of the work. The payment bond shall be binding on the Contractor, the subContractor(s), and their successors and assigns for the payment of all indebtedness to all persons for labor and services performed, materials furnished or services rendered. The surety of the payment bond may not be released until one (1) year after the board's final settlement with the Contractor.

The successful Contractor shall furnish and pay for an approved one hundred percent (100%) **Performance Bond** (Indiana Form 86A) pursuant to the provisions of I.C. 36-1-12-14 covering the faithful performance of the Contract and the payment of all obligations arising thereunder, with such sureties as the Owner may approve, prior to work beginning. The Performance Bond serves as a guarantee that all provisions of the bid, the attached specifications and resulting Contract shall be met. The surety of the performance bond may not be released until one (1) year after the date of the board's final settlement with the Contractor.

6. OR EQUAL CLAUSE

Whenever, in any section of the Contract Documents, an article, material, or equipment is defined by describing a proprietary product, generic term or by using the name of a manufacturer or Responder, the term "or equal", if not inserted, shall be implied. The specific article, material, or equipment mentioned shall be understood as indicating the type, function, minimum standard of design, efficiency, and quality desired and shall not be construed in such a manner as to exclude manufacturer's products of comparable quality, design and efficiency.

7. CONTRACTOR'S INSURANCE

The Contractor shall not commence any Work under this Contract until he has obtained insurance of the types and in the amounts required by this Section, nor shall the Contractor allow any SubContractor(s) to commence any Work on his Subcontract until all insurance required of the SubContractor(s) has been obtained. The Contractor shall be responsible for verifying the acquisition and maintenance of said insurance by any SubContractor(s) hired by the Contractor. The Contractor shall name the City of Evansville as an additional insured to all insurance contracts procured by the Contractor in accordance with this Section. All insurance procured by the Contractor is to be placed with insurers whom maintain a Best's rating of no less than A:VII. The Contractor shall be solely responsible for the payment of all premiums associated with any insurance required by Owner, and the Contractor shall be solely responsible for the payment of all deductibles to which such policies are subject, whether or not the Owner is an insured under the policy. The Contractor shall advise all SubContractor(s) of the requirements set forth above.

Commercial General Liability (CGL) Insurance: The Contractor shall furnish and maintain, at the Contractor's expense during the life of the Contract, such Commercial General Liability Insurance as shall protect him, the Owner, as an additional insured, and any SubContractor(s) performing Work under this Contract, from claims for damage for personal injury, occupational sickness or disease, including accidental death, as well as the claims for property damage, which may arise from operations under this Contract, whether such operations be by himself or by any SubContractor(s), or by any one directly or indirectly employed by either of them. The amounts of such insurance shall be as required by law. The Owner shall have the right to reject the insurance carrier selected by the Contractor. No Work shall commence prior to the Owner receiving a certificate of insurance verifying the coverages to be provided as defined herein. In the absence of regulations, the amounts of coverage shall be as follows:

General Aggregate:	**Not Less Than $2,000,000**
Products & Completed	**Not Less Than $2,000,000**
Operations Aggregate:	**Not Less Than $2,000,000**
Personal & Advertising Injury:	**Not Less Than $1,000,000**
Each Occurrence:	**Not Less Than $1,000,000**
Fire Damage (Any one fire):	**Not less Than $ 300,000**
Medical Expense (Any one person):	**Not Less Than $5,000**

Umbrella/Excess Liability: The Contractor shall furnish and maintain Umbrella and/or Excess Liability, over and above the limits noted above in the CGL section of this agreement, with limits of at least $3,000,000 per occurrence with a corresponding $3,000,000 Aggregate limit. This limit shall be reflected on a submitted Certificate of Insurance with all Additional Insured and Indemnification language to correspond and follow all underlying terms and conditions of the CGL policy.

Worker's Compensation Insurance: The Contractor shall furnish certificates from the Worker's Compensation Board of Indiana, or its successor, that he is fully covered by Worker's Compensation and Occupational Diseases insurance, on all Employees on the Project. The Contractor shall maintain said coverage for the life of the Contract. The same requirements pertain to any SubContractor(s). The Contractor shall be responsible for verifying that all SubContractor(s) have Workmen's Compensation and Occupational Insurance Coverage. No Work shall commerce prior to the Owner receiving a certificate of insurance verifying the coverages provided herein. For any work to be conducted or performed on or over navigable waters, the Workers Compensation certificate must include proof of coverage to include related to the United States Longshore and Harbor (USL&H) Workers Compensation Act as defined in U.S. Code 33, Chapter 18.

Errors & Omissions (E&O) Liability for Specified Contractor Types: In addition to provision of General Liability and Workers Compensation Insurance, for work to be performed by "professional" services entities (i.e. – Architects, Engineers, Surveyors, Inspection Services), proof should be provided indicating coverage for Professional Liability indicating limits of not less than $1,000,000 per occurrence with a corresponding $1,000,000 Aggregate limit.

Automobile Liability: The Contractor shall furnish and maintain, at his expense during the life of the Contract, automobile liability insurance, covering claims for damages because of bodily injury, death or property damage arising from the use of all motor vehicles engaged in operating within the terms of this Contract. The amounts of such combined single limit coverage shall be not less than ($1,000,000) for any one occurrence, including hired and non-owned vehicles. All SubContractor(s) of the Contractor shall have similar automobile liability insurance. The Contractor shall be responsible for verifying that all SubContractor(s) have said automobile liability insurance. Coverage 1 shall apply. No Work shall commence prior to the Owner receiving a certificate of insurance verifying the coverage provided herein.

Special Hazards: Special Hazards, as determined by the Owner, shall be covered by rider or riders in amounts to be agreed upon, to the Liability Insurance policy or policies required to be furnished by the Contractor, and all SubContractor(s) employed by the Contractor, or by separate policies of insurance in the amounts as defined in the Special Conditions of the Contract Documents. All such special Hazards insurance coverage shall have the Owner as an additional insured. No Work requiring special hazard coverage shall commence until the Owner has received a certificate of insurance verifying the coverage required herein.

Builder's Risk Insurance: The Contractor, and all SubContractor(s) employed by the Contractor, shall maintain Builder's Risk Insurance, "all risk" coverage, on the Project for the benefit of the Owner. The Contractor shall be responsible for verifying that all SubContractor(s) have the required Builder's Risk Insurance coverage.

However, this provision shall not release the Contractor from his obligation to complete the Project, and the Contractor and his Surety shall be obligated to full performance of the Contract.

SubContractor(s) Insurance: The Contractor shall require all SubContractor(s) to secure and maintain in force during the term of this Contract, all such insurance coverages defined above. The Contractor shall verify the existence of all said insurance policies and coverages. No Work by a SubContractor(s) shall commence prior to the Owner receiving a certificate of insurance verifying the coverage required herein.

Other Provisions: Any failure to comply with reporting provisions of the policies shall not affect coverage provided to the Owner, its officers, officials, employees and volunteers by the Contractor and SubContractor(s). The Contractor's and SubContractor's insurance shall apply separately to each insured against whom claim is made or suit is brought except with respect to the limits of the insurer's liability. The insurer shall agree to waive all rights of subrogation against the Owner, its officers, officials, employees and volunteers for losses arising from Work performed by the Contract for the Owner. The Contractor shall be responsible for notifying all insurance carriers of this contract provision and shall be liable to the Owner for any failure to so notify and advise any insurance carrier of this provision.

8. PROOF OF INSURANCE

The Contractor shall furnish the Owner with satisfactory proof of coverage of the insurance required, in a reliable company or companies to be approved by the Owner, licensed to do business in the State of Indiana, before commencing any Work. Such proof shall consist of certificates executed by the respective insurance companies, filed with the Owner. The certificates of insurance shall show the name and address of the Company, expiration date or dates, and the policy number or numbers. The Owner reserves the right to require complete, certified copies of all required insurance policies at any time.

Proof of insurance shall be maintained up to date, and failure to maintain adequate coverage and proof shall be deemed sufficient reason for cancellation of the Contract. All insurance shall provide that the policy shall not be canceled, terminated or modified unless thirty (30) days prior to

such cancellation, termination or modification written notice is given to the Owner. No policy may be modified, terminated or canceled by the Contractor without the prior written approval of the Owner.

9. SHOP DRAWINGS AND SAMPLES

The Contractor shall submit, in a prompt manner, at least two copies of all shop or Project Drawings and schedules for every item of equipment or material to be incorporated in the Work which is fabricated or manufactured off site, including those pertaining to structural and reinforcing steel, electrical, plumbing, carpentry, heating and ventilation. The Contractor shall make any corrections required by the Owner or Engineer, and resubmit the required revised Project Drawings without delay. The Engineer's review of such Drawings shall extend only to determining the conformity of such equipment and materials with the general features of the Project Drawings and Specifications prepared by the Engineer.

It shall be the responsibility of the Contractor to determine the correctness of all Specifications and dimensions and minor details of such equipment and materials so that they will fit into the completed Work, and so that when incorporated in the Work, correct operation will result. The Contractor shall furnish for approval all samples required by the Specifications. The Work shall be in accordance with approved samples.

10. PERMITS, SURVEYS AND COMPLIANCE WITH LAWS

The Contractor shall keep fully informed of Federal, State and Municipal laws, ordinances, regulations, codes and standards, or any other bodies having jurisdiction or authority, which in any manner may affect the conduct of the Work or the Work of any employee. The Contractor shall at all times observe and comply with all such laws, ordinances, regulations, codes and standards. The Contractor shall protect, indemnify, and exculpate the Owner and its representatives, against any civil claim or civil liability arising from or based on the violation or any such laws, ordinances, regulations, codes and standards whether by himself or his employees, even if such violation is due wholly or in part to violation of said laws, ordinances, regulations, codes or standards by the Owner or its representatives.

The Contractor shall give all notices, and procure and pay for all permits, licenses and bonds, necessary for the prosecution of the Work, as required by Municipal, State and Federal ordinances, regulations, codes and laws, unless specifically provided otherwise in the Special Conditions or the Specifications. If the Contractor observes that the Project Drawings and Specifications are at variance with rules, codes or laws, he shall promptly notify the Owner or Engineer in writing, and any necessary changes shall be made as provided in the Contract for changes in the Work. If the Contractor performs any Work knowing it to be contrary to such laws, ordinances, rules and regulations, and gives no notice to the Owner or Engineer, he shall bear all costs and damages, including but not limited to attorney's fees, arising from said Work.
The Owner will furnish all site surveys, unless otherwise provided. The Contractor shall provide construction staking, unless otherwise provided.

11. ROYALTIES AND PATENTS

The Contractor shall pay all royalties and license fees for any patented product used by him or incorporated in the Work. The Contractor shall defend all suits or claims for infringement of any patent right brought against himself or the Owner, and shall save the Owner harmless from liability or loss or damage of any nature or kind, including costs, expenses and attorney's fees arising from the infringement or allegation of infringement of any patent or patent right, or because of any royalty, fee or license for the use, arrangement or operation of any tools, machinery, appliances, devices or materials which may be used by the Contractor or furnished by him in fulfillment of the requirements of this Contract.

12. PROTECTION OF WORK AND PROPERTY

The Contractor shall continuously maintain adequate protection and security of the Project site, and shall indemnify the property of the Owner and any adjacent property from injury, damage, loss or claim, including a claim for attorney's fees, arising in connection with this Contract. The Contractor shall exercise due diligence at all times in protection of persons and property from injury. The Contractor shall promptly notify the Owner of any accidents arising in the course of operations under the Contract causing bodily injury or property damage.

The Contractor and any SubContractor(s) employed by the Contractor, will be responsible for any and all damage to person(s) or property, public or private, that may be caused by his operation in the performance of this Contract, and the Contractor shall defend any suit that may be brought against himself or the Owner on account of damage inflicted by his operations, and shall be liable for any attorney's fees incurred by the Owner, and any judgments awarded against the Owner, Contractor or SubContractor(s) employed by the Contractor arising from such damage.

13. MATERIALS AND WORKMANSHIP

Unless otherwise stipulated, in writing and approved by the Owner, the Contractor shall provide and pay for all material, labor, water, tools, equipment, light, power, heat transportation and other facilities necessary for the execution and completion of the Work.

Unless otherwise stipulated in the Specifications, all workmanship, equipment, materials and articles incorporated in the Work shall be new and of the best grade of their respective kinds. When required by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials.

The Contractor shall at all times enforce strict discipline and good order among his employees, and shall not employ on the Project any unfit person, or anyone not skilled in the Work assigned to him.

When required by the Specifications, or when called for by the Owner, the Contractor shall obtain the Owner's approval of the materials or articles to be used in the Work. The Contractor in obtaining this approval shall furnish the Owner full information concerning the materials or articles which he contemplates incorporating in the Work. Samples of materials shall be submitted for approval when so directed. Machinery, equipment, materials and articles installed or used without such approval shall be used at the risk of the Contractor. All materials and workmanship shall be guaranteed by the Contractor and the Surety for a period of three years from the date of final acceptance. The Contractor further guarantees the materials and workmanship of all Work performed by any SubContractor(s) employed on the Project by the Contractor for a period of three (3) years from the date of final acceptance of the Work.

No material of any kind shall be installed in the Project until it has been inspected and accepted by the Engineer. All material rejected shall be immediately removed from the site of the Work and not again offered for inspection. Any materials or workmanship found at any time to be defective shall be remedied at once regardless of previous inspections.
At any time during the course of construction of the Project, when, in the opinion of the Engineer, provisions of the Contract Documents are being violated by the Contractor, its employees, or any SubContractor(s) hired by the Contractor, the Engineer will have the right and authority to order all construction to cease and require the removal and replacement of all defective Work. In the event the Engineer orders a cessation of any Work, the Contractor shall not proceed until arrangements satisfactory to the Engineer are made by the Contractor for resumption of the Work in compliance with the provisions of the Contract Documents. It shall not be construed as a waiver of defects if the Engineer shall not order the Work stopped or material removed, as the case may be. The Contractor shall be liable for the cost of any defective Work performed by the Contractor or any SubContractor(s) employed by the Contractor.

14. INSPECTION OF WORK AND TESTING OF MATERIALS

The Owner and Engineer shall at all times have access to the Work, and the Contractor shall provide proper facilities for access and for inspection of the Work. All material to be incorporated in the Work, all labor performed, and all tools, appliances and methods used, shall be subject to the inspection and approval or rejection of the Owner. Any Work rejected by the Owner by reason of defective materials, workmanship or that said Work fails to comply with the Contract Documents shall be repaired at the expense of the Contractor.

The Contractor, and any SubContractor(s) hired by the Contractor, shall execute the Work only in the presence of the Engineer or his Inspector, during normal working hours unless provision has been made for Work on other shifts. The presence of the Engineer or inspector shall in no way relieve the Contractor of the responsibility of his Contract, or be any warrant for the furnishing of bad materials or poor workmanship.

The inspection and supervision of the Work by the Engineer is intended to aid the Owner in determining whether the labor, materials, and workmanship being provided by the Contractor or a SubContractor(s) hired by the Contractor are in compliance with the Contract Documents. Any inspection and supervision by the Engineer shall not operate to release the Contractor from any of his Contract obligations, or be deemed as the acceptance of such Work.

All laboratory tests shall be made by a testing laboratory employed by the Contractor and approved by the Engineer. The cost of tests shall be paid by the Contractor. Unless otherwise provided in the Special Conditions, the Contractor shall furnish the materials to be tested, and incidental material and labor required at the site in connection with the tests, the costs of which shall be considered to be included in the price or prices for the Contract items.

Where in Contract Documents, laws, ordinances, codes, or the Engineer's instructions require any Work to be specially tested or approved, the Contractor shall give the Owner or Engineer timely notice of the readiness of the Work for inspection, and if the inspection is performed by any person other than the Owner or Engineer, of the date and time fixed for the inspection. Inspections by the Owner or Engineer shall be made promptly. If any Work should be covered up without approval or consent of the Owner or Engineer, it must, if required by the Engineer, be uncovered for examination at the Contractor's expense.

No material of any kind shall be installed in the Project until it has been inspected and accepted by the Engineer. All material rejected shall be immediately removed from the site of the Work and not reused for any Work associated with the Project. Any materials or workmanship found at any time to be defective shall be remedied at once regardless of previous inspections.

The Owner shall have the right, at any time before final acceptance of the Project, or at any other time, to make an examination of the Work already completed. Where necessary, the Owner in conducting any inspection may remove or tear out any Work previously performed. The Contractor, at the request of the Owner, shall promptly furnish all necessary facilities, labor and materials required to perform any inspection. If any Work is found to be defective in any material respect due to fault of the Contractor, or his SubContractor(s), the Contractor shall be liable for any expense incurred by reason of the examination and any reconstruction. If, however, such Work is found to meet the requirements of the Contract, the actual cost of labor and materials necessarily involved in the examination and replacement, plus fifteen percent (15%), will be allowed the Contractor in payment for the examination.

15. CONTRACTOR'S SUPERINTENDENT

The Contractor shall have at the site of the Work at all times a competent foreman, superintendent, or other representative satisfactory to the Owner, to supervise the Work of the Contractor and the Work of any SubContractor(s) hired by the Contractor. All such persons shall have the authority to act for the Contractor, and all instructions given to such person by the Engineer shall be followed and shall be as binding as if given to the Contractor. All directions which are required by the General Conditions, Project Drawings, or Specifications to be given by the Owner shall be given in writing.

All supervisory personnel employed by the Contractor or a SubContractor(s) hired by the Contractor shall give efficient supervision to the Work, using his best skill and attention, and shall carefully study and compare all Project Drawings, Specifications and other instructions, and shall at once report to the Owner or Engineer any error, inconsistency or omission which they might discover.

16. RECEIVING OF SHIPMENTS

Shipments of material to be used by the Contractor or any SubContractor(s) should be delivered to the site only during the regular working hours of the Contractor or SubContractor(s). If a delivery is made during other than normal working hours, an authorized employee or agent must be on duty to receive such materials. No employee of the Owner or Engineer shall be authorized to receive any shipments of materials.

17. USE OF PREMISES

The Contractor and any SubContractor(s) hired by the Contractor shall confine his workmen, materials and operations to limits indicated on the Project Drawings. The Contractor shall not impede any Work to be performed on the Project with his materials. The Contractor shall enforce the Owner's instructions regarding signs, advertisements, fires and smoke.

18. CUTTING, PATCHING AND DIGGING

The Contractor shall do all cutting, fitting or patching of his Work that may be required to make its several parts fit together properly as shown upon or reasonably implied by, the Project Drawings and Specifications for the completed Work.

Any claim for damages arising from any negligent, defective or ill-timed Work shall be borne by the party responsible therefor. However, the Contractor shall indemnify the Owner against all claims arising from negligent, defective or ill-timed Work performed by the Contractor or any SubContractor(s) hired by the Contractor. The Contractor shall not endanger any Work by cutting, digging or otherwise, and shall not cut or alter the Work or any other Contractor without the consent of the Owner or Engineer.

19. CLEANING UP

The Contractor shall at all times keep the premises free from accumulations of waste material or rubbish caused by his employees or Work, and at the completion of the Work he shall remove all his rubbish from the site and all his tools and surplus materials and shall leave his Work "broom clean" or its equivalent, unless instructed differently. In case of dispute the Owner may remove the rubbish and charge the cost to the Contractor at a rate the Owner shall determine to be just.

20. WAGE RATES

The Contractor shall agree to comply with all State and Federal statutory requirements pertaining to wage rates applicable to this contract, including, but not limited to Indiana Code 5-16-13. The Contractor represents and warrants that prior to commencing any Work he has familiarized himself with any said laws. The Contractor shall require all of his SubContractor(s) to comply with all State and Federal Statutory requirements pertaining to wages which may be applicable to this Contract including but not limited to Indiana Code 5-16-13. Failure to comply with any such statutory requirements shall constitute a material breach of the Contract, and may result in the Owner taking one or more of the following actions:

a) Referral of suspected violations of state or federal law to appropriate law enforcement agencies; and/or,
b) Rescinding or voiding the Contract; and/or,
c) Invoking all other legal and equitable remedies available.

The Contractor and its SubContractor(s) agree to fully cooperate with the Owner in his efforts to investigate and verify compliance with applicable wage laws. Such cooperation shall include, but not be limited to, permitting on-site questioning of employees of the Contractor or SubContractor(s) and reasonable access for inspection of all relevant records of the Contractor or SubContractor(s).

The Contractor shall be liable for all costs, including attorney's fees, incurred by the Owner by reason of the failure of the Contractor or SubContractor(s) hired by the Contractor to comply with these provisions.

21. HIRING OF LABOR - RACE DISCRIMINATION

Every Contract for or on behalf of the State of Indiana, or any municipal corporation thereof, for the construction, alteration or repair of any public building or public Work, shall contain provisions by which the Contractor agrees:

a) That in the hiring of employees for the performance of Work under this Contract, or any Subcontract hereunder, no Contractor, SubContractor(s) nor any person acting on behalf of such Contractor or SubContractor(s), shall by reason of race or color, discriminate against any citizen of the State of Indiana who is qualified and available to perform the Work to which the employment relates; and,

b) That no Contractor, SubContractor(s), nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee hired for the performance of Work under this Contract on account of race or color; and,

c) That there may be deducted from the amount payable to the Contractor by the Owner, under this Contract, a penalty of not less than ten dollars ($10.00) or more than two thousand five hundred ($2,500.00) for each person for each calendar day during which such person was discriminated against or intimidated in violation of the provisions of the Contract; and,

d) That this Contract may be canceled or terminated by the Owner, and all money due or to become due hereunder may be forfeited, for a second or any subsequent violation of the terms or conditions of this section of the Contract; and,

e) The Contractor shall indemnify the Owner against all losses and claims, including attorney's fees, arising from the failure by the Contractor to comply with this provision.

22. ALLOWANCES

The Contractor has included in the Contract Price an amount associated with any allowances named in the Contract Documents, and shall cause the Work so covered to be done by such SubContractor(s), and for such sums as the Owner or Engineer may direct, the Contract Price being adjusted in conformity therewith. The Contractor declares that the Contract Price includes such sums for expense and profit on account of cash allowances as he deems proper.

No demand for expenses or profit other than those included in the Contract Price will be allowed, unless said demand has been previously authorized by the Owner in writing. The Contractor shall not be required to employ any such persons against whom he has a reasonable objection.

23. CHANGES IN THE WORK

The Owner may, without invalidating the Contract, order extra Work or make changes by altering, adding to, or deducting from the Work. All such Work shall be executed under the conditions of the original Contract Document, except that any claim for extension of time caused thereby shall be made at the time of the ordering of such change. Any modifications ordered by the Owner shall cause the Contract Price to be modified in an amount to be agreed in writing, by the parties, and approved by the appropriate Board prior to any such Work being performed.

Adjustment, if any, in the amounts to be paid to the Contractor by reason of any such changes shall be determined by one or more of the following methods:

a) By Unit Prices contained in the Contractor's original bid and incorporated in this Contract; or,

b) By a supplemental schedule of prices contained in the Contractor's original bid and incorporated in this Contract;

c) By an acceptable lump sum or unit price proposal of the Contractor; or,

d) On a cost plus basis, not to exceed a specified limit, defined as the cost of labor, materials, and insurance, plus a specified percentage of cost of such labor, materials and insurance; provided the specified percentage does not exceed fifteen percent (15%) of the aggregate of the cost of such labor, materials, and insurance.

In cases where a lump sum proposal is submitted by the Contractor in excess of Five Hundred Dollars ($500) and the Owner considers the lump sum proposal excessive or unreasonable, the Owner shall have the right to solicit Contract Proposals for the additional or modified Work from other Contractors.

In cases where additional Work is ordered by the Owner which was not contemplated in the original proposal, or where the additional Work ordered by the Owner has a cost of construction in excess of twenty percent of the original Contract Price for any item constituting five percent or more of the total Contract Price, the Owner is required by Indiana statutes to seek bid proposals from other Contractors for such Work. If a proposal for such added Work is obtained from another Contractor at an amount less than the proposal submitted by the Contractor, the Owner reserves the right to make an award of such Work to the lower proposal, or to negotiate further with the Contractor.

The Engineer is not authorized to act for the Owner in giving orders for extra or additional Work, either in writing or verbally. Extra Work or changes in quantities must be approved by the appropriate Board of the Owner prior to Work being performed.

If the Contractor claims that any instruction, by drawing or otherwise, results in the Contractor being entitled to receive additional payment under this Contract, he shall give the Owner written notice thereof within a reasonable time after the receipt of such instructions. In no event shall the Contractor be authorized to proceed to execute the Work without the prior written consent of the Owner.

24. CLAIMS FOR EXTRA COST

If the Contractor claims that any instruction, by Project Drawings or otherwise, involves extra cost under this Contract, he shall give the Owner or Engineer written notice thereof within a reasonable time after the receipt of such instruction, and in no event shall the Contractor proceed or authorize a SubContractor(s) to proceed to perform the Work, except in emergency endangering life or property, until the Contractor has complied with the provisions in Section 23, "Changes in The Work". The Owner shall have no liability for a claim for extra cost unless the Contractor has complied with Section 23 prior to commencing the extra Work.

25. OWNER'S RIGHT TO DO WORK

If the Contractor neglects to prosecute the Work as required by the terms of the Contract Documents, Project Drawings or Specifications, the Owner may, after three (3) days written notice to the Contractor, without prejudice to any other remedy he may have, make good such deficiencies and may deduct the cost thereof from the payment due the Contractor.

26. DEDUCTIONS FOR UNCORRECTED WORK

The Contractor agrees that the Owner may at its discretion waive the right to correct Work injured, defective Work, defective materials, or Work and materials not provided in accordance with the terms of the Contract Documents, Project Drawings and Specifications. The Contractor consents to the Owner exercising its discretion to deduct from the Contract Price a reasonable amount associated with said injured Work, defective Work, defective materials, or Work and materials provided which are not in accordance with the Contract Documents, Project Drawings and Specifications.

27. TERMINATION FOR BREACH

In the event that any provision of this Contract is violated by the Contractor or by any of his SubContractor(s), or if the Contractor should become a debtor in a bankruptcy proceedings, or if he should make a general assignment of his assets for the benefit of his creditors, or if a receiver should be appointed for any reason on account of his insolvency, or if he should persistently or repeatedly fail to supply sufficiently skilled workmen or proper materials as required by the Specifications, Project Drawings and Contract Documents, or if he should disregard the instruction of the Engineer, then the Owner may serve written notice upon the Contractor and the Surety of its intention to terminate this Contract, specifying the reasons for such intent to terminate. If, within ten (10) days after the serving of such notice, the Contractor has failed to correct the listed deficiencies to the satisfaction of the Owner, the Contractor shall be deemed in default. In the event of default, the Contract shall be deemed terminated, the Owner shall immediately serve notice thereof upon the Contractor and Surety. The Surety shall then take over and perform the Contract, provided, however, that if the Surety does not commence performance thereof within thirty (30) days from the date of the mailing to such Surety of notice of termination, the Owner may take over the Work and prosecute the same to completion. The Contractor and the Surety shall be jointly liable for all expenses, including but not limited to labor, materials, administrative expense and attorney's fees, incurred by the Owner in completing the Contract, and recovering the costs associated therewith.

28. COMPLETION OF WORK BEFORE FINAL PAYMENT

In cases where the Contractor has failed to complete minor items of Work within the time set for completion of the Contract, but limited to cases where the value of such uncompleted Work does not exceed five (5) percent of the total construction cost of the Work, then the Owner shall have the right without terminating this Contract, to complete said items of Work, deducting from the sums due the Contractor under this Contract the total cost which the Owner may incur in completing such minor items of Work by force account, or by employing some other Contractor to complete such minor items of Work. Prior to completing such items of Work, the Owner shall deliver to the Contractor a written statement, enumerating and describing the items not completed, and demanding completion of same, within a time to be fixed in such statement by the Owner. The time set forth in such statement must depend on the time reasonably required for the performance of the Work in question, but shall not in any event be less than ten days, nor more than thirty days. If the Contractor refuses or neglects to comply within the time stated, the Owner may proceed to complete the Contract, and the Contractor shall be liable to the Owner for all expenses, including but not limited to labor, materials, administrative expenses and attorney's fees, incurred in the completion of the Contract and the recovery of all costs associated therewith.

29. CORRECTION OF WORK AFTER FINAL PAYMENT

Neither the act of final payment nor any provision in the Contract Documents shall relieve the Contractor of responsibility for negligence in the furnishing and installation of faulty materials or workmanship, and unless otherwise specified, the Contractor shall remedy at his expense any such defects, whether such defects were caused by the Work of the Contractor, or any SubContractor(s) hired by the Contractor, and pay for any damage resulting therefrom, which shall appear within a period of three years from the date of final acceptance. The Owner shall give notice of observed defects with reasonable promptness.

30. DELAYS AND EXTENSION OF TIME

If the Contractor is delayed in the progress of the Work by any act of neglect of the Owner or the Engineer, or by any other Contractor employed by the Owner, or by changes ordered in the Work, or by strikes, lockouts, fire, unusual delay in transportation, unavoidable casualties, or by causes beyond the Contractor's control, or by delay authorized by the Owner, or by any cause which the Owner deems to justify the delay, then the time of completion shall be extended for such reasonable time as the Owner may decide.

31. CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE

If the Work is ordered stopped by an order of any court, or other public authority, for a period of three months, through no act or fault of the Contractor, anyone employed by him, or any SubContractor(s) hired by the Contractor, the Contractor may, upon seven (7) days written notice to the Owner, stop Work or terminate this Contract and recover from the Owner payment for all Work satisfactorily performed.

32. DISPUTES

All disputes concerning the interpretation of the General Conditions, Project Drawings or Specifications, questions of fact arising under this Contract shall be decided by the Engineer, subject to written appeal by the Contractor, within ten days, to the Owner, whose decision shall be final and conclusive upon the parties hereto. In the meantime, the Contractor shall diligently proceed with the Work as directed.

33. DAMAGES

If the Owner should suffer damage in any manner because of any act of the Contractor, anyone employed by him, or any SubContractor(s) hired by the Contractor, then the Owner shall be indemnified by the Contractor for all cost arising, including but not limited to attorney's fees. Claims under this clause shall be made in writing to the Contractor within a reasonable time, at the first notice of such damage.

34. PAYMENT

Payment for Work completed and accepted will be based on the Contract unit price for the actual quantities of materials used unless stipulated otherwise. Payment in the amount of ninety percent (90%) of the progress estimate, approved by the Engineer, will be made on the following schedule for projects with a total cost of less than $200,000. Payment in the amount of ninety-five percent (95%) of the progress estimate, approved by the Engineer, will be made on the following schedule for projects costing more than $200,000:

a) Progress Estimates must be delivered to the Engineer by the Friday following the last day of the month. An original detailed invoice, along with a signed, completed claim form, will be required. The act of submitting any claim for the payment of any Work shall expressly be a representation by the Contractor that the Contractor, and any SubContractor(s) hired by the Contractor, have complied with the provisions of Section 20 herein.

b) If the billing is in order, to the satisfaction of the Engineer, it will be signed by the Engineer, and forwarded to the appropriate Board for approval at their next meeting. Incomplete invoices, improper billings, or uncompleted Work may cause delays in processing.

c) After approval by the Board, the Claim will be processed for payment. A check will normally be written within thirty (30) days of receipt of a proper invoice and a valid, signed claim.

d) Within thirty (30) days of the completion of the Work, a final inspection will be held. The Contractor will be notified of the date of this inspection, but attendance is not required. A written summary of requirements for remedial or repair Work will be communicated to the Contractor, and payment of retainage will not be made until all remedial Work cited by the Engineer is completed to the satisfaction of the Engineer. Bills for final claims will be processed in the manner outlined in Paragraphs a), b) and c) above.

On Projects where factors beyond the control of the Contractor cause unreasonable delays in completion of the Project and final payment, or where the Owner determines that satisfactory progress is being made, the ten percent retainage may be reduced at the discretion of the Owner. Reduced retainage must cover the potential cost of replacement or repair of uncompleted or improperly completed portions of the Work. Retainage will normally not be reduced below five percent (5%) until substantial completion of the Project. The Contractor shall submit "Consent of Surety" on AIA Document G707A, "Consent of Surety to Reduction in or Partial Release of Retainage", prior to any request for reduction of retainage.

An Escrow Agreement, as pertains to the Provisions of Indiana Code 36-1-12-14, shall not apply to this contract.

35. FINAL PAYMENT / WAIVER OF LIEN / GUARANTEE

Final payment shall not become due until the Contractor has furnished the Owner an affidavit that all bills or claims from SubContractor(s), material suppliers of the Contractor and SubContractor(s) and labor costs of the Contractor and SubContractor(s) in connection with the Contract have been paid.

The Contractor's right to payment will be based on the units of material in place, as determined by the Engineer, in accordance with the provisions set forth in the Contract Documents. Any materials, workmanship or equipment furnished by the Contractor, or any SubContractor(s) hired by the Contractor, a part of this Contract which proves to be defective or fails to operate properly within three (3) years following the date of Owner's acceptance of the Work (excepting any damage resulting from normal wear and tear, or violence or casualty not the fault of the Contractor) shall be promptly repaired and replaced by the Contractor upon notification from the Owner. All such replacement and repair Work shall be done at the cost of the Contractor. The Contractor shall indemnify the Owner against all costs or claims arising from any defective material, workmanship or equipment provided by the Contractor, or any SubContractor(s) hired by the Contractor. The date of acceptance shall be established by the Engineer only after all Work under this Contract has been substantially completed as to quality of workmanship and materials.

36. SEPARATE CONTRACTS

The Owner reserves the right to let other Contracts in connection with other Work associated with the Project but which is not the subject of this Contract. The Contractor shall afford other Contractors reasonable access to the site of the Project for the delivery and storage of materials and the performance of their Work, and shall properly connect and coordinate his Work.

If any part of the Contractor's Work requires the coordination of Work of any other Contractor, the complete Work to be performed by another Contractor, or Work to be performed by the Owner, the Contractor shall coordinate all such Work and shall inspect and promptly report to the Owner or Engineer any defects in such Work that prohibits the Contractor from performing his Work. Failure by the Contractor to so inspect and report shall constitute an acceptance of the other's Work as fit and proper for the reception of his Work, except as to defects which may develop in the other Contractor's Work after the execution of the Work.

To ensure the proper execution of his subsequent Work, the Contractor shall measure Work already in place, and shall at once report to the Owner or Engineer any discrepancy between the executed Work and the Project Drawings.

37. ASSIGNMENT

The Contractor shall not assign the Contract or sublet it as a whole, nor shall he assign any monies due or to become due to him hereunder, without the previous written consent of the Owner.

38. SUBCONTRACTS

The Contractor shall, as soon as practicable after the execution of the Contract, notify the Owner or Engineer in writing of the names of SubContractor(s) which the Contractor proposes to have perform any Work, and the Owner or Engineer may within a reasonable time object the use of said SubContractor(s) as incompetent or unfit.

If the Contractor has submitted before execution of the Contract a list of SubContractor(s), and the change of any name on such list is required to be approved in writing by the Owner after such execution, the Contract price shall be increased or decreased by the difference in cost occasioned by such change. The Contractor agrees that he is as fully responsible to the Owner for the acts and omissions of his SubContractor(s), and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

Nothing contained in the Contract Documents shall create any contractual relation between any SubContractor(s) and the Owner.

39. RELATIONS OF CONTRACTOR AND SUBCONTRACTOR

The Contractor agrees to bind every SubContractor(s), and every SubContractor(s) shall agree to be bound by the terms of the Contract, and the Contract Documents, as far as applicable to his Work, including the following provisions, unless specifically noted to the contrary in a Subcontract approved in writing as adequate by the Owner and Engineer.

a) The SubContractor(s) shall agree:

(1) To be bound to the Contractor by the terms of the Contract, and the Contract Documents, and to assume toward him all the obligations and responsibilities that the Contractor, by these documents, assumes toward the Owner.

(2) To make all claims for extras, for extensions of time, and for damages for delays or otherwise, to the Contractor, in the manner provided in the Contract Documents for like claims by the Contractor upon the Owner, except that the time for making claims for extra cost is one week.

b) The Contractor shall agree:

(1) To be bound to the SubContractor(s) by all the obligations that the Owner assumes to the Contractor under this Contract, and the Contract Documents, and by all provisions thereof affording remedies and redress to the Contractor from the Owner.

(2) To pay the SubContractor(s) to such extent as may be provided by the Contract Documents or the Subcontract.

(3) To make no demand for liquidated damages or penalty for delay in any sum in excess of such amount as may be specifically named in the Subcontract.

(4) That no claim for services rendered or materials furnished by the Contractor to the SubContractor(s) shall be valid unless written notice thereof is given by the Contractor to the SubContractor(s) during the first ten days of the calendar month following that in which the claim originated.

Nothing in this article shall create any obligation on the part of the Owner to pay to or to see to the payment of any sums of any Subcontract.

40. COMPLIANCE WITH E-VERIFY PROGRAM

Pursuant to IC 22-5-1.7, Contractor shall enroll in and verify the work eligibility status of all newly hired employees of Contractor through the E-Verify Program ("Program"). Contractor is not required to verify the work eligibility status of all newly hired employees through the Program if the Program no longer exists.

Contractor and its subContractors shall not knowingly employ or contract with an unauthorized alien or retain an employee or contract with a person that Contractor or its subContractor subsequently learns is an unauthorized alien. If Contractor violates this Section 16.23, Owner shall require Contractor to remedy the violation not later than thirty (30) days after Owner notifies Contractor. If Contractor fails to remedy the violation within the thirty (30) period, Owner shall terminate the contract for breach of contract. If Owner terminates the contract, Contractor shall, in addition to any other contractual remedies, be liable to Owner for actual damages. There is a rebuttable presumption that Contractor did not knowingly employ an unauthorized alien if Contractor verified the work eligibility status of the employee through the Program.

If Contractor employs or contracts with an unauthorized alien but Owner determines that terminating the contract would be detrimental to the public interest or public property, Owner may allow the contract to remain in effect until Owner procures a new Contractor.

Contractor shall, prior to performing any work, require each subContractor to certify to Contractor that the subContractor does not knowingly employ or contract with an unauthorized alien and has enrolled in the Program. Contractor shall maintain on file a certification from each subContractor throughout the duration of the Project. If Contractor determines that a subContractor is in violation of this Section 16.23, Contractor may terminate its contract with the subContractor for such violation. Such termination may not be considered a breach of contract by Contractor or the subContractor.

41. PUBLIC CONSTRUCTION PROJECTS

The Evansville Municipal Code (EMC) Chapter 3.95 addresses topics concerning Public Construction Projects of the City of Evansville.

- Random Drug Testing Required. Pursuant to EMC 3.95.020 Contractor shall maintain a random drug testing program for all construction contracts where the cost of the contract is more than $10,000.

- License Required at Time of Submission of Bid. Pursuant to EMC 3.95.030 Contractor, and every subContractor to be used on a project, shall be properly licensed to do the work by the Evansville-Vanderburgh County Building Commission office at the time the bid or quote is opened. Any bid or quote by a Contractor not so licensed, or indicating the use of a subContractor not so licensed, shall be rejected as nonresponsive to the bid or quote request, or the bidder or quoter shall be determined to be a nonresponsible bidder or quoter.

- Responsible Bidding Practices and Submission Requirements. Pursuant to EMC 3.95.040 each Contractor proposing to submit bids on any City of Evansville public works project estimated to be at least $150,000 or more must, prior to the bid submission deadline, be designated as a Responsible Bidder as identified in EMC 3.95.040. Each first-tier subContractor shall be required to adhere to the requirements of the Responsible Bidder ordinance as though it were bidding directly to the City, except that first-tier subContractors shall submit the required information to the bidder and the bidder shall then forward said information to the City.

42. PROTECTION OF PERSONS AND PROPERTY

Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connect with the performance of the Contract. Upon award of Contract, the Contractor shall submit a written copy of all the Company's Safety and Health Programs, and the annual employee safety training plan.

Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

When use or storage or explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner.