



SBAC Gainesville High School Building 27 HVAC Renovation Gainesville, Florida

**Phase: Early Release Package #2
Hydronic Equipment**

SBAC Project No. H1710
H2E Project No. 18-71
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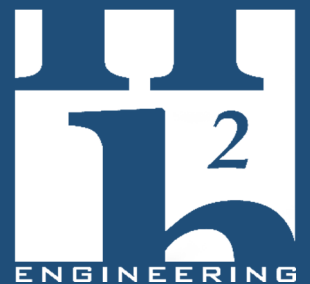
Early Release Package #2

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Section 1

Technical Specifications





SECTION 230120 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, and other submittals.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.
- D. USB Thumb Drive: A data storage device that includes flash memory with an integrated USB interface.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.



- B. Deviations and Additional Information: On an attached separate sheet, prepared on equipment vendor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- C. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.
- D. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections. Submittals on USB thumb drives shall be included in the equipment vendor's bid package. The submittals will be reviewed during the bid process. Bids will not be accepted without associated submittal packages.
 - 1. Electronic submittals shall be distributed to the School Board of Alachua County on USB thumb drives in the bid package.
 - 2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:



- a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data in the following format:
 - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm) . Sheets sizes of 11 by 17 inches or 24 by 36 inches are preferred by the Owner.
 3. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
- D. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.



PART 3 - EXECUTION

3.1 ENGINEER'S ACTION

- A. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Engineer without action.
- F. Submittals on any particular phase of Work will receive only one review and one re-review (if required). If additional reviews are required beyond these two, the equipment vendor will be charged \$100.00 per hour for review time.

END OF SECTION 230120



SECTION 230150 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.



1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation of a comparable product request. Engineer will notify equipment vendor of approval or rejection of proposed comparable product.
 - a. Use product specified if Engineer does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 230120 "Submittal Procedures." Show compliance with requirements.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Deliver specified equipment to Gainesville High School, Building 27, Gainesville, Florida. Equipment start-up shall be conducted on site at Gainesville High School, Building 27, Gainesville, Florida. Coordinate equipment delivery date with School Board of Alachua County's Project Manager, Construction Manager Project Manager, and installing Mechanical Sub-Contractor.
- C. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site, Gainesville High School Building 27, and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- D. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.



3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.



3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Engineer will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. **Product:** Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions other than from the manufacturers specifically listed will not be considered.
2. **Manufacturer/Source:** Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for equipment vendor's convenience will not be considered.
3. **Products:**
 - a. **Restricted List:** Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions from manufacturers not listed will not be considered unless otherwise indicated.
4. **Manufacturers:**
 - a. **Restricted List:** Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions from manufacturers not listed will not be considered unless otherwise indicated.
5. **Basis-of-Design Product:** Where Specifications name a product, or refer to a product indicated on Drawings/equipment schedules, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

- C. **Visual Selection Specification:** Where Specifications include the phrase "as selected by Engineer from manufacturer's full range" or similar phrase, select a product that complies with requirements. Engineer will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. **Conditions for Consideration:** Engineer will consider listed manufacturer's request for comparable product to basis-of-design when the following conditions are satisfied. If the



following conditions are not satisfied, Engineer may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of engineers and owners, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 230150



SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract apply to this Section.

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.



2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Power factor: 0.80.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Re-greasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F.
- I. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable-Frequency Controllers:
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
- B. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.



- C. Motors 1/20 HP and Smaller: Shaded-pole type.
- D. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513



SECTION 236423.13 - AIR-COOLED, SCROLL WATER CHILLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes air-cooled scroll water chillers.

1.3 DEFINITIONS

- A. BAS: Building automation system.
- B. DDC: Direct digital control.
- C. GFI: Ground fault interrupt.
- D. I / O: Input / output.
- E. SCCR: Short-circuit current rating.
- F. SPD: Surge Protective Device.
- G. TEAO: Totally enclosed air over.
- H. TENV: Totally enclosed non-ventilating.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include refrigerant, rated capacities, operating characteristics, and furnished specialties and accessories.
 - 2. Performance at AHRI standard conditions and at conditions indicated.
 - 3. Performance at AHRI standard unloading conditions.
 - 4. Minimum evaporator flow rate.
 - 5. Refrigerant capacity of water chiller.
 - 6. Oil capacity of water chiller.
 - 7. Fluid capacity of evaporator.



- B. Shop Drawings: Complete set of manufacturer's prints of water chiller assemblies, control panels, sections and elevations, and unit isolation. Include the following:
 - 1. Assembled unit dimensions.
 - 2. Weight and load distribution.
 - 3. Required clearances for maintenance and operation.
 - 4. Size and location of piping and wiring connections.
 - 5. Diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Installation instructions.
- B. Startup service reports.
- C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each water chiller to include in emergency, operation, and maintenance manuals.
- B. Spare Parts List: Recommended spare parts list with quantity for each.
- C. Touchup Paint Description: Detailed description of paint used in application of finish coat to allow for procurement of a matching paint.
- D. Instructional Videos: Including those that are prerecorded and those that are recorded during training.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Touchup Paint: 32 oz. (1 L) container of paint used for finish coat. Label outside of container with detailed description of paint to allow for procurement of a matching paint in the future.

1.8 QUALITY ASSURANCE

- A. AHRI Certification: Certify chiller according to AHRI 590 certification program.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Ship water chillers from the factory fully charged with refrigerant and filled with oil.



1.10 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of water chillers that fail in materials or workmanship within specified warranty period.

- 1. Entire Unit Warranty

- a. Period: One year from date of Substantial Completion.
- b. Warranty to include, but are not limited to, the following:
 - 1) Complete chiller product including refrigeration and electrical components.
 - 2) Complete compressor and drive assembly including refrigerant and oil charge.
 - 3) Refrigerant and oil charge.
 - a) Loss of refrigerant charge for any reason due to manufacturer's product defect.
 - 4) Parts and labor.
- c. Warranty shall indicate that service personnel will provide same day on-site response to Owner warranty call.

- 2. Extended Warranty

- a. Period: Years two (2) through five (5) from date of Substantial Completion.
- b. Warranty to include:
 - 1) Compressor(s) parts and labor to repair/replace compressor(s).
- c. Warranty shall indicate that service personnel will provide same day on-site response to Owner warranty call.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AHRI Rating: Rate water chiller performance according to requirements in AHRI 550 / 590.
- B. ASHRAE Compliance: ASHRAE 15 for safety code for mechanical refrigeration.
- C. ASHRAE / IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- D. ASME Compliance: Fabricate and stamp water chiller heat exchangers to comply with ASME Boiler and Pressure Vessel Code.
- E. Comply with NFPA 70.



2.2 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Daikin Applied.
 2. Quantec.
 3. Trane.
 4. York International Corporation.

2.3 MANUFACTURED UNITS

- A. Description: Factory-assembled and run-tested water chiller complete with compressor(s), compressor motors and motor controllers, evaporator, condenser with fans, electrical power, controls, and indicated accessories.
- B. Fabricate water chiller mounting base with reinforcement strong enough to resist water chiller movement during a seismic event when water chiller is anchored to field support structure.
- C. Sound-reduction package shall have the following:
1. Acoustic enclosure around compressors.

2.4 CABINET

- A. Base: Galvanized-steel base extending the perimeter of water chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.
- B. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported from base.
- C. Casing: Galvanized steel.
- D. Finish: Coat base, frame, and casing with a corrosion-resistant coating capable of withstanding a 500-hour salt-spray test according to ASTM B 117.

2.5 COMPRESSOR-DRIVE ASSEMBLIES

- A. Compressors:
1. Description: Positive-displacement direct drive with hermetically sealed casing.
 2. Each compressor provided with suction and discharge service valves, crankcase oil heater, and suction strainer.
 - a. For multiple compressor assemblies, it is acceptable to isolate each compressor assembly in lieu of each compressor.



3. Operating Speed: Nominal 3600 rpm for 60-Hz applications.
4. Capacity Control: On-off compressor cycling.
5. Oil Lubrication System: Automatic pump with strainer, sight glass, filling connection, filter with magnetic plug or removable magnet in sump, and initial oil charge.
 - a. Manufacturer's other standard methods of providing positive lubrication are acceptable in lieu of an automatic pump.
6. Vibration Isolation: Mount individual compressors on vibration isolators.
 - a. For multiple compressor assemblies, it is acceptable to isolate each compressor assembly in lieu of each compressor.

B. Compressor Motors:

1. Hermetically sealed and cooled by refrigerant suction gas.
2. High-torque, two-pole induction type with inherent thermal-overload protection on each phase.

C. Compressor Motor Controllers:

1. Across the Line: NEMA ICS 2, Class A, full voltage, non-reversing.

2.6 REFRIGERATION

- A. Refrigerant: R-410A or R-407C. Classified as Safety Group A1 according to ASHRAE 34.
- B. Refrigerant Compatibility: Parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
- C. Refrigerant Circuit: Each circuit shall include an electronic or a thermal-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
- D. Refrigerant Isolation: Factory install positive shutoff isolation valves in the compressor discharge line and the refrigerant liquid-line to allow the isolation and storage of the refrigerant charge in the chiller condenser.
 1. For multiple compressor assemblies, it is acceptable to isolate each compressor assembly in each circuit in lieu of each compressor.
- E. Pressure Relief Device:
 1. Comply with requirements in ASHRAE 15, ASHRAE 147, and applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.



2. Select and configure pressure relief devices to protect against corrosion and inadvertent release of refrigerant.
3. ASME-rated, spring-loaded, pressure relief valve; single- or multiple-reseating type. Pressure relief valve(s) shall be provided for each heat exchanger.

2.7 EVAPORATOR

A. Brazed Plate:

1. Direct-expansion, single-pass, brazed-plate design.
2. Type 316 stainless-steel construction.
3. Code Compliance: Tested according to ASME Boiler and Pressure Vessel Code.
4. Fluid Nozzles: Terminate with mechanical-coupling end connections for connection to field piping.
5. Inlet Strainer: Factory-furnished, 20 or 40-mesh strainer for field installation in supply piping to evaporator. Manufacturer has option to factory install strainer.

B. Flow Switch: Factory-furnished thermal-type flow switch wired to chiller operating controls.

C. Heater: Factory-installed and -wired electric heater with integral controls designed to protect the evaporator to minus 20 deg F (minus 29 deg C).

2.8 AIR-COOLED CONDENSER

A. Aluminum Microchannel Coils:

1. Series of flat tubes containing a series of multiple, parallel-flow micro-channels layered between refrigerant header manifolds.
2. Single- or multiple-pass arrangement.
3. Construct fins, tubes, and header manifolds of aluminum alloy treated with a corrosion-resistant coating.

B. Fans: VFD, direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.

C. Fan Motors: TENV or TEAO enclosure, with sealed and permanently lubricated bearings, and having built-in overcurrent- and thermal-overload protection.

1. Overcurrent- and thermal-overload protection not integral to motor is acceptable if provided with chiller electrical power package.

D. Fan Guards: Removable steel safety guards with corrosion-resistant PVC coating.



2.9 INSULATION

- A. Closed-cell, flexible, elastomeric thermal insulation complying with ASTM C 534 / C 534M, Type I for tubular materials and Type II for sheet materials.
 - 1. Thickness: 1-1/2 inches (38 mm).
- B. Adhesive: As recommended by insulation manufacturer.
- C. Factory-applied insulation over all cold surfaces of chiller capable of forming condensation. Components shall include, but not be limited to, evaporator, evaporator water boxes including nozzles, refrigerant suction pipe from evaporator to compressor, cold surfaces of compressor, refrigerant-cooled motor, and auxiliary piping.
 - 1. Apply adhesive to 100 percent of insulation contact surface.
 - 2. Before insulating steel surfaces, prepare surfaces for paint, and prime and paint as indicated for other painted components. Do not insulate unpainted steel surfaces.
 - 3. Seal seams and joints to provide a vapor barrier.
 - 4. After adhesive has fully cured, paint exposed surfaces of insulation to match other painted parts.

2.10 ELECTRICAL

- A. Factory installed and wired, and functionally tested at factory before shipment.
- B. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a multi-point field power connection to water chiller.
- C. House in a unit-mounted, NEMA 250, Type 3R enclosure with hinged access door with lock and key or padlock and key.
- D. Wiring shall be numbered and color-coded to match wiring diagram.
- E. Field power interface shall be to wire lugs. Minimum SCCR according to UL 508 shall be as required by electrical power distribution system, but not less than 65,000 A.
- F. Each motor shall have branch power circuit and controls with one of the following disconnecting means having SCCR to match main disconnecting means:
 - 1. UL 489, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
- G. Each motor shall have overcurrent protection.
- H. Overload relay sized according to UL 1995, or an integral component of water chiller control microprocessor.
- I. Phase-Failure and Under-voltage: Solid-state sensing with adjustable settings.



- J. Controls Transformer: Unit-mounted transformer with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
- K. Control Relays: Auxiliary and adjustable time-delay relays, or an integral to water chiller microprocessor.
- L. Indicate the following for water chiller electrical power supply:
 - 1. Current, phase to phase, for all three phases.
 - 2. Voltage, phase to phase and phase to neutral for all three phases.
 - 3. Three-phase real power (kilowatts).
 - 4. Three-phase reactive power (kilovolt amperes reactive).
 - 5. Power factor.
 - 6. Running log of total power versus time (kilowatt hours).
 - 7. Fault log, with time and date of each.

2.11 CONTROLS

- A. Factory installed and wired, and functionally tested at factory before shipment.
- B. Standalone, microprocessor based, with all memory stored in nonvolatile memory so that reprogramming is not required on loss of electrical power.
- C. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure of matching construction.
- D. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, digital display. Display the following:
 - 1. Date and time.
 - 2. Operating or alarm status.
 - 3. Operating hours.
 - 4. Outside-air temperature if required for chilled-water reset.
 - 5. Temperature and pressure of operating set points.
 - 6. Chilled-water entering and leaving temperatures.
 - 7. Refrigerant pressures in evaporator and condenser.
 - 8. Saturation temperature in evaporator and condenser.
 - 9. No cooling load condition.
 - 10. Elapsed time meter (compressor run status).
 - 11. Pump status.
 - 12. Anti-recycling timer status.
 - 13. Percent of maximum motor amperage.
 - 14. Current-limit set point.
 - 15. Number of compressor starts.
 - 16. Alarm history with retention of operational data before unit shutdown.
 - 17. Superheat.
- E. Control Functions:



1. Manual or automatic startup and shutdown time schedule.
 2. Capacity control based on evaporator leaving-fluid temperature.
 3. Capacity control compensated by rate of change of evaporator entering-fluid temperature.
 4. Chilled-water entering and leaving temperatures, control set points, and motor load limit.
 5. Current limit and demand limit.
 6. Condenser-water temperature.
 7. External water chiller emergency stop.
 8. Anti-recycling timer.
- F. Manual-Reset Safety Controls: The following conditions shall shut down water chiller and require manual reset:
1. Low evaporator pressure or high condenser pressure.
 2. Low chilled-water temperature.
 3. Refrigerant high pressure.
 4. High or low oil pressure.
 5. High oil temperature.
 6. Loss of chilled-water flow.
 7. Loss of condenser-water flow.
 8. Control device failure.
 9. Undervoltage.
 10. Phase-Loss.
- G. BAS System Interface: Factory-install hardware and software to enable system to monitor, control, and display chiller status and alarms.
1. Hardwired I/O Points:
 - a. Monitoring: On / off status, common trouble alarm.
 - b. Control: On / off operation, chilled-water discharge temperature set-point adjustment, and electrical power demand limit.
 2. Communication Interface: ASHRAE 135 (BACnet) communication interface shall enable control system operator to remotely control and monitor the water chiller from an operator workstation. Control features and monitoring points displayed locally at water chiller control panel shall be available through DDC system for HVAC.
- H. Factory-installed wiring outside of enclosures shall be in NFPA 70-complaint raceway. Make terminal connections with liquid-tight or flexible metallic conduit.
- I. Transient Voltage Surge Suppression:
1. General:
 - a. All SPDs shall be provided by the same manufacturer.
 2. Incoming Power SPDs



- a. Basis-of-Design Product: Subject to compliance with requirements, provide Surge Suppression, Inc.; CDLB3Y_D1X or a comparable product by one of the following:
- 1) Liebert Corporation.
 - 2) Current Technology.
- b. Description: Parallel connected, type 2 SPD, Type 1 and Type 4 SPDs not permitted, listed to ANSI/UL 1449-2006 (UL 1449 3rd Edition). .
- c. Peak Surge Current: 180 kA per phase.
- d. Nominal Discharge Current Rating: 20 kA per mode for all modes.
- e. The Maximum Continuous Operating Voltage (MCOV) shall be as follows:

Nominal System Voltage	Mode	MCOV
120/208 Wye	L-N	150 V
	L-L	300 V
	L-G	150 V
	N-G	150 V
277/480 Wye	L-N	320 V
	L-L	550 V
	L-G	320 V
	N-G	320 V

- f. The SPD shall have Voltage Protection Ratings (VPRs) as follows:

Nominal System Voltage	Mode	VPR
120/208 Wye	L-N	600 V
	L-L	1000 V
	L-G	600 V
	N-G	700 V
277/480 Wye	L-N	1200 V
	L-L	1800 V
	L-G	1200 V
	N-G	1200 V

- g. Diagnostics: LED indicator lights for power and protection status.
- h. Circuit Design: Parallel wired design incorporating all mode protection and “True” sine-wave tracking based on the results of the Category A (2kV) Ring Wave Measured Limiting Voltages.
- i. Solid-state clamping components to limit the surge voltage and divert the surge current. SPD components that “crowbar” (e.g. spark gaps, gas tubes, SCR’s, etc.) are not allowed.
- j. Self-restoring and fully automatic.
- k. Capable of sustaining 115% of nominal RMS voltage continuously without degrading.
- l. Bi-directional, thermal stress reducing, encapsulated, custom parallel and solid state circuit configuration.



- m. SPD system shall provide discrete protection for all 10 modes for a three-phase Wye-connected SPD. Distinct and independent protection circuitry for each mode is required.
 - n. Enclosure: NEMA 4X, Composite Fiberglass.
 - o. Disconnect: Integral, non-fused.
 - p. Short Circuit Current Rating: 200 kAIC.
 - q. Installation:
 - 1) Chiller manufacturer shall factory install SPD at mechanical disconnect.
 - 2) Install SPD with conductors between main lugs and SPD not exceeding 18 inches and as straight as possible. Where chiller control panel cannot accommodate lead length less than 18 inches, chiller manufacturer shall contact SPD manufacturer for alternative installation.
3. Control Power SPD:
- a. Basis-of-Design Product: Subject to compliance with requirements, provide Surge Suppression, Inc.; S-SPT###-30 or a comparable product by one of the following:
 - 1) Liebert Corporation.
 - 2) Current Technology.
 - b. Description: Series connected type 2 SPD, Type 1 and Type 4 SPDs not permitted, listed to ANSI/UL 1449-2006 (UL 1449 3rd Edition).
 - c. Peak Surge Current: 120 kA per phase.
 - d. Enclosure: Plastic with mounting feet or DIN rail.
 - e. Connections: 3-position screw terminal strips.
 - f. Diagnostics: LED indicator lights for power and protection status.
 - g. Circuit Design: Series wired design incorporating all mode protection and “True” sine-wave tracking based on the results of the Category A (2kV) Ring Wave Measured Limiting Voltages.
 - h. Current Rating: 30 amps.
 - i. Installation: Chiller manufacturer shall factory install SPD at load side of control transformer prior to and in series with chiller controls.
4. BAS Hardwired Points SPD:
- a. Basis-of-Design Product: Subject to compliance with requirements, provide Surge Suppression, Inc.; CLP24Ax-B or a comparable product by one of the following:
 - 1) Liebert Corporation.
 - 2) Current Technology.
 - b. Description: Series connected SPD.
 - c. Peak Surge Current: 10 kA per phase.
 - d. Enclosure: Plastic with mounting feet or DIN rail.
 - e. Connections: Screw terminal strips.
 - f. Circuit Design: Series wired design incorporating all mode protection.



- g. Current Rating: 500 mA.
- h. Maximum Data Rate: 2 Mbps.
- i. Installation: Chiller manufacturer shall factory install SPD in control panel ready to accept building automation hardwired terminations. Provide SPD or multiple SPDs to accommodate quantity of hardwired terminations specified.

5. BAS Communication Interface SPD:

- a. Basis-of-Design Product: Subject to compliance with requirements, provide Surge Suppression, Inc.; DRJ45##C8-B or a comparable product by one of the following:
 - 1) Liebert Corporation.
 - 2) Current Technology.
- b. Description: Series connected SPD.
- c. Peak Surge Current: 10 kA per phase.
- d. Enclosure: Plastic with mounting feet or DIN rail.
- e. Connections: RJ45 modular connectors.
- f. Circuit Design: Series wired design incorporating all mode protection.
- g. Current Rating: 500 mA.
- h. Maximum Data Rate: 100 Mbps.
- i. Installation: Chiller manufacturer shall factory install SPD in control panel ready to accept building automation communication interface.

2.12 ACCESSORIES

- A. Factory-furnished, chilled-differential pressure type water flow switches for field installation.
- B. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigeration circuit.
- C. Factory-furnished neoprene isolators for field installation.

2.13 CHARACTERISTICS

- A. Low Ambient Operation: Chiller designed for operation to 0 deg F (minus 18 deg C) .
- B. High Ambient Operation: Chiller designed for operation to 115 deg F (46 deg C).
- C. Evaporator:
 - 1. Pressure Rating: 653 psig.
 - 2. Fouling Factor: 0.0001 sq. ft. x h x deg F/Btu (0.000018 sq. m x deg C/W).
- D. Controls Power Connection: Fed through integral transformer and SPD.
- E. Noise Rating: Measured according to AHRI 370.



PART 3 - EXECUTION

3.1 WATER CHILLER INSTALLATION

- A. Chiller manufacturer's factory-trained service personnel shall charge water chiller with refrigerant if not factory charged and fill with oil if not factory installed.
- B. Install separate devices furnished by manufacturer and not factory installed.
 - 1. Chillers shipped in multiple major assemblies shall be field assembled by chiller manufacturer's factory-trained service personnel.

3.2 STARTUP SERVICE

- A. Factory-authorized service representative to perform startup service.
- B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.
- C. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - 1. Verify that refrigerant charge is sufficient and water chiller has been leak tested.
 - 2. Verify that pumps are installed and functional.
 - 3. Verify that thermometers and gages are installed.
 - 4. Operate water chiller for run-in period.
 - 5. Check bearing lubrication and oil levels.
 - 6. Verify proper motor rotation.
 - 7. Verify static deflection of vibration isolators, including deflection during water chiller startup and shutdown.
 - 8. Verify and record performance of chilled-water flow and low-temperature interlocks.
 - 9. Verify and record performance of water chiller protection devices.
 - 10. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
- D. Visually inspect chiller for damage before starting. Repair or replace damaged components, including insulation. Do not start chiller until damage that is detrimental to operation has been corrected.
- E. Prepare a written startup report that records results of tests and inspections.

3.3 DEMONSTRATION

- A. Factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water chillers.



1. Instructor shall be factory trained and certified.
2. Provide not less than eight hours of training.
3. Train personnel in operation and maintenance and to obtain maximum efficiency in plant operation.
4. Provide instructional videos showing general operation and maintenance that are coordinated with operation and maintenance manuals.
5. Obtain Owner sign-off that training is complete.
6. Owner training shall be held at Project site.

END OF SECTION 236423.13



SECTION 237313 - MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Casing panels shall be self-supporting and capable of withstanding the greater of 8-inches wg or 133 percent of internal static pressures indicated, without panel joints exceeding a deflection of $L/200$ where "L" is the unsupported span length within completed casings.
- B. Leakage: The casing leakage rate shall not exceed 0.5 cfm per square foot of cabinet area at 6-inches of negative static pressure or 5-inches of positive static pressure (0.0025 m/s per square meter of cabinet area at 1.24 kPA static pressure).
- C. Condensation: During first year guarantee period, if condensation forms on any section of air handler when unit is operating at design conditions, contractor shall replace or repair unit to correct the situation. Repairs shall not impair unit or component accessibility and future repair ability and inherent access for maintenance. All repairs shall be subject to Engineer's approval.

1.3 ACTION SUBMITTALS

- A. Product Data: For each air-handling unit indicated.
 - 1. Unit dimensions and weight.
 - 2. Cabinet material, metal thickness, finishes, insulation, and accessories.
 - 3. Fans:
 - a. Certified fan-performance curves with system operating conditions indicated.
 - b. Fan construction and accessories.
 - c. Motor ratings, electrical characteristics, and motor accessories.
 - 4. Certified coil-performance ratings with system operating conditions indicated.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Filters with performance characteristics.

B. CLOSEOUT SUBMITTALS



- C. Operation and Maintenance Data: For air-handling units to include in emergency, operation, and maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filters: One set(s) for each air-handling unit.
 - 2. Gaskets: One set(s) for each access door.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.
- C. ARI Certification: Air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.
- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- E. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- F. Comply with NFPA 70.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to replace components of units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period:
 - a. Provide manufacturer's standard warranty one year from date of Substantial Completion.

1.7 DELIVERY, COORDINATION, AND HANDLING

- A. Comply with requirements in Section 230150 "Product Requirements" for additional requirements.



PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Daikin Applied.
 2. Tempmaster.
 3. Trane.
 4. YORK; a Johnson Controls company.

2.2 UNIT CASINGS

A. General Fabrication Requirements for Casings:

1. Forming Fabricate with channel posts and panels: Form walls, roofs, and floors with at least two breaks at each joint. Panels and access doors shall be constructed as 2-inch (50 mm) nominal thick; thermal broke double wall assembly.
2. Casing Joints: Mechanical fasteners.
3. Sealing: All panels and ship sections shall be sealed with permanently applied bulb-type gaskets. Shipped loose gasketing is not allowed. Module to module assembly shall be accomplished with an overlapping, full perimeter, insulated, internal splice joint sealed with bulb type gasketing on both mating modules.
4. Casings: Galvanized-Steel
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
6. Blank Offs: Provide where required to insure no air bypass between sections, through perforated panels or around coils or filters.

B. Casing Insulation and Adhesive:

1. Materials: ASTM C 1071, Type II fiberglass or injected foam insulation with a composite minimum R-value or R-13.
2. Location and Application: Encased between outside and inside casing.

C. Access Doors:

1. Door Fabrication: Formed and reinforced, double-wall and insulated panels of same materials and thicknesses as casing.
2. Access Doors:
 - a. Hinges: A minimum of two ball-bearing hinges or minimum 6 inch (150 mm) stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.



- b. Gasket: Permanently applied neoprene bulb-type gaskets, applied around entire perimeters of panel frames. Shipped loose gasketing is not allowed
 - c. Size: At least 24 inches (600 mm) wide by full height of unit casing up to a maximum height of 60 inches (1500 mm).
 - 3. Locations and Applications:
 - a. Fan Section: Doors.
 - b. Access Section: Doors.
 - c. Damper Section: Doors.
 - d. Filter Section: Doors large enough to allow periodic removal and installation of filters.
 - e. Mixing Section: Doors.
- D. Condensate Drain Pans:
 - 1. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and from humidifiers and to direct water toward drain connection.
 - a. Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
 - b. Depth: A minimum of 2 inches (50 mm) deep.
 - 2. Formed sections.
 - 3. Double-wall, stainless-steel sheet with space between walls filled with foam insulation and moisture-tight seal.
 - 4. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
 - a. Minimum Connection Size: NPS 1 (DN 25).
 - 5. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.
- E. Air-Handling-Unit Mounting Frame: 8-inch (200 mm) high full perimeter formed galvanized-steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs. Welded or bolted cross members shall be provided as required for lateral stability.

2.3 FAN, DRIVE, AND MOTOR SECTION

- A. Fan and Drive Assemblies: Statically and dynamically balanced on all three planes and at all bearing points and designed for continuous operation at maximum-rated fan speed and motor horsepower.
 - 1. Shafts: Designed for continuous operation at maximum-rated fan speed and motor horsepower, and with field-adjustable alignment.



- a. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
 - b. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
 2. Performance:
 - a. Select at a maximum total static pressure of 90% of the fan's peak static pressure capability at the specified fan/motor speed.
- B. Plenum Fan Housings: Steel frame and panel; fabricated without fan scroll and volute housing.
 1. Intake Wall: 11 gauge, A60 Galvanized steel
 2. Inlet Funnel: 14 gauge spun steel
 3. Motor Support Plate and Structure: 11 gauge G90 Galvanized steel
 4. Finish: The intake wall, inlet funnel, and motor support structure shall be powder coated.
- C. Fan Shaft Bearings:
 1. Grease-Lubricated Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing with grease lines extended to outside unit.
- D. Internal Vibration Isolation: Fans shall be factory mounted with manufacturer's standard rubber-in-shear vibration isolation mounting devices having a minimum static deflection of 1/4 inch (6 mm)
- E. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 1. Enclosure Type: Totally enclosed, fan cooled.
 2. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
 3. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 4. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
 5. Electrically commutated motor wired to control panel with integral disconnect, individual motor protection, and control terminals. Control terminal for speed control, enable, and alarm contacts. Speed control shall be via common 0-10Vdc signal at control panel without need for variable frequency controller. Provide hand-off-auto (HOA) single point switch on control panel.

2.4 COIL SECTION

A. General Requirements for Coil Section:

1. Comply with ARI 410.



2. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. Coils shall not act as structural component of unit and shall be removable through side and/or top panels of unit without need to remove and disassemble the entire section from the unit.
4. Enclose coil headers and return bends completely within unit casing.
5. Coil connections shall be factory sealed with grommets on interior and exterior and gasket sleeve between outer wall and liner to minimize air leakage and condensation inside panel assembly. If not factory packaged; contractor shall supply all coil connection grommets and sleeves.
6. Vent and drain fittings shall be furnished on coil connections exterior to the air handler.

2.5 AIR FILTRATION SECTION

A. General Requirements for Air Filtration Section:

1. Comply with NFPA 90A.
2. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
3. Provide filter holding frames arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

B. Extended-Surface, Disposable Panel Filters:

1. Provide 3M MERV A13 Mini-Pleat with Gasket.
2. Factory-fabricated, dry, extended-surface type.
3. Thickness: 2 inches (50 mm).
4. Initial Resistance: 0.39 inches wg (62 Pa).
5. Recommended Final Resistance: 1.4 inches wg (249 Pa).
6. MERV (ASHRAE 52.2): 14.
7. Media: Fibrous material formed into mini-pleats with antimicrobial agent and held by self-supporting wire grid.
8. Media-Grid Frame: Nonflammable cardboard with integral gasket.
9. Mounting Frames: Welded, galvanized steel, with gaskets and fasteners, suitable for bolting together into built-up filter banks.

2.6 ADDITIONAL SECTIONS

- A. Access Sections: Provide to allow access between coils and as otherwise required or indicated. Access section shall be a minimum of 24 inches (610 mm) deep.
- B. Custom Section(s): Provided by the air handler manufacturer as an integral section of the unit for field installation of special components.
- C. Inlet and/or Discharge Plenum: Provide with single or multiple openings as indicated.



2.7 AIR-TO-AIR ENERGY RECOVERY

A. Heat-Pipe Heat Exchangers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Applied Air; Mestek Technology, Inc.
 - b. Des Champs Technologies.
 - c. Engineered Air.
 - d. Gaylord Industries, Inc.
 - e. Heat Pipe Technology, Inc.
2. Casing: Galvanized-steel flanged casing, with airtight partition between airstreams.
3. Refrigerant: ASHRAE 15, Group 1. HCFC-free refrigerant.
4. Tubes: 5/8-inch- (16-mm-) diameter, copper.
5. Fins: Aluminum.
 - a. Maximum Fin Spacing: 12 fins per inch (mm).
 - b. Fin and Tube Joint: Mechanical bond.

2.8 CAPACITIES AND CHARACTERISTICS

A. Casing:

1. Outside Casing: G90 galvanized steel, minimum 0.064 inch (1.6 mm) thick.
2. Inside Casing: G90 galvanized steel, solid, minimum 0.052 inch (1.3 mm) thick.
3. Floor Plate: G90 galvanized steel, minimum 0.064 inch (1.6 mm) thick.
4. Insulation Thickness: 2 inches (50 mm).
5. Static-Pressure Classifications for Unit Sections before Fans: 6-inch wg (1500 Pa).
6. Static-Pressure Classifications for Unit Sections after Fans: 8-inch wg (2000 Pa).

B. Supply Fan:

1. Class II: AMCA 99-2408.
2. Drive: Direct.
3. Type: Aluminum, airfoil centrifugal.
4. Fan Housing and Wheel Coating: Powder-baked enamel.

C. Cooling Coil:

1. Maximum Face Velocity: 500 fpm (152 m/s).
2. Maximum Air-Side, Static-Pressure Drop: 1.0 inches wg (249 Pa).
3. Coil Type: Self-draining.
4. Piping Connections: Threaded, same end of coil.
5. Tube Material: Copper.
6. Tube Diameter: 0.625 inches (16 mm).
7. Tube Thickness: 0.025 inches (0.64 mm).



8. Fin Type: Plate.
9. Fin Material: Aluminum.
10. Maximum Fin Spacing: 12 fins per inch (2.1 fins per mm).
11. Fin Thickness: 0.0075 inch (0.19 mm).
12. Fin and Tube Joint: Mechanical bond.
13. Headers: Seamless copper tube with brazed joints, prime coated.
14. Frames: Channel frame, 0.0625-inch (- 1.58-mm-) thick stainless steel.
15. Coil Working-Pressure Ratings: 200 psig (1380 kPa), 325 deg F (163 deg C).
16. Water: Maximum Water Pressure Drop: 10.0 feet of head (29.8 kPa).
17. Coating: Factory applied corrosion-resistant coating. Coil shall have a factory applied flexible, epoxy polymer e-coat uniformly applied to all coil surface areas without material bridging between fins. Humidity and water immersion resistance shall be up to a minimum 1,000 and 250 hours respectively (ASTM D2247-92 and ASTM D870-92). Corrosion durability shall be confirmed through testing to no less than 6,000 hours salt spray per ASTM B117-90. Coated coils shall receive a spray-applied, UV-resistant polyurethane topcoat to prevent UV degradation of the e-coat. Coating shall carry a 5 year non-prorated warranty.

2.9 SOURCE QUALITY CONTROL

- A. Fan Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.
- B. Fan Performance Rating: Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency. Rate performance according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating."
- C. Water Coils: Factory tested to 300 psig (2070 kPa) according to ARI 410 and ASHRAE 33.

PART 3 - EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect and handle products to site.
- B. Deliver products on site in factory-fabricated protective containers, with factory-installed shipping skids. Inspect for damage.
- C. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.



3.2 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, fill water coils with water, and test coils and connections for leaks.
 - 2. Charge refrigerant coils with refrigerant and test for leaks.
 - 3. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Air-handling unit or components will be considered defective if unit or components do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.3 STARTUP SERVICE

- A. Factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify that shipping, blocking, and bracing are removed.
 - 3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
 - 4. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
 - 5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
 - 6. Verify that face-and-bypass dampers provide full face flow.
 - 7. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.
 - 8. Comb coil fins for parallel orientation.
 - 9. Verify that proper thermal-overload protection is installed for electric coils.
 - 10. Install new, clean filters.
 - 11. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.
- B. Starting procedures for air-handling units include the following:
 - 1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace fan and motor pulleys as required to achieve design conditions.
 - 2. Measure and record motor electrical values for voltage and amperage.



3. Manually operate dampers from fully closed to fully open position and record fan performance.

3.4 DEMONSTRATION

- A. Factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.

END OF SECTION 237313

Section 2

Hydronic Equipment Schedules



AIR COOLED CHILLER SCHEDULE		
DESIGNATION		CH-1
REFRIGERATION CAPACITY NOMINAL (TONS)		110
REFRIGERATION CAPACITY REQUIRED (TONS)		111.5
ENT WATER TEMP (DEG F)		44
LVG WATER TEMP (DEG F)		56
EER/PLV		10.7/17.5
AIR ENT CONDENSER (DEG F)		95
CHILLED WATER FLOW (GPM)		220
MAX WATER PRESSURE DROP (FT)		7
CHILLER FOULING FACTOR		0.001
UNIT DATA		
NUMBER OF COMPRESSORS (#)		4
NUMBER OF FANS (#)		8
UNIT CAPACITY STEPS		7
COMPRESSOR STARTER TYPE		ACROSS THE LINE
REFRIGERANT TYPE		R-410A
ELECTRICAL DATA		
ELECTRICAL CHAR (V-PH)		208/3
UNIT MCA (A)		490
UNIT MOCP (A)		600
MAX TOTAL INPUT POWER (KW)		126

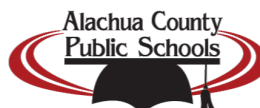
NOTES (PROVIDE FOLLOWING OPTIONS):

- 1.) PROVIDE 120V/1 PHASE POWER CONNECTION FOR EVAPORATION HEAT TAPE.
- 2.) PROVIDE FULL EQUIPMENT WARRANTY WITH NO EXCLUSIONS. SEE SPECIFICATIONS.
- 3.) PROVIDE SINGLE POINT POWER.

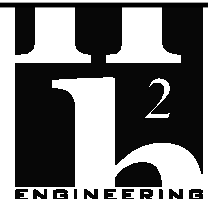
AIR HANDLING UNIT SCHEDULE				
DESIGNATION		AHU-1W	AHU-2W	AHU-5W
AIR HANDLING UNIT DATA				
TOTAL SUPPLY AIR (CFM)		2300	5000	3100
OUTSIDE AIR (CFM)		400	1500	800
FILTER SECTION DATA				
DAMPERS		NONE	NONE	NONE
FILTER ORIENTATION		ANGLED	ANGLED	ANGLED
TYPE OF FILTER		2" PLEATED MERV 13	2" PLEATED MERV 13	2" PLEATED MERV 13
COOLING COIL DATA - MAX 120 FPF, 10 ROWS AND MOX FLUID PRESSURE DROP 10 FT				
TOTAL COOLING CAPACITY (MBTUH)		68.6	170	92.1
SENSIBLE COOLING CAPACITY (MBTUH)		59.5	129.0	80.0
AIR ENTERING COOLING COIL (DEB F DW/ DEG F WB)		75.8/62.4	75.7/63.7	75.7/62.4
AIR LEAVING COOLING COIL (DEB F DW/ DEG F WB)		52.0/51.8	52.0/51.8	52.0/51.8
MAX AIR PRESSURE DROP AT COIL (IN W.G.)		0.75	0.75	0.75
WATER FLOW (GPM)		8.6	22	12
CHILLED WATER ENTERING TEMPERATURE (DEG F)		44	44	44
CHILLED WATER LEAVING TEMPERATURE (DEG F)		60	60	60
MINIMUM FACE AREA (SF)		6	10	6
RUNOUT PIPE SIZE (IN)		1	1 1/4	1 1/4
CONTROL VALVE (TYPE)		SEE SCHEDULE	SEE SCHEDULE	SEE SCHEDULE
FAN SECTION DATA				
FAN TYPE		PLUNUM	PLUNUM	PLUNUM
DRIVE TYPE		DIRECT	DIRECT	DIRECT
FAN QUANTITY (#)		1	1	1
EXTERNAL STATIC PRESSURE (INCLUDING FILTER) (IN W.G.)		2.0	2.0	2.0
MAXIMUM TOTAL STATIC PRESSURE (IN W.G.)		3.5	3.5	3.5
TOTAL FAN MOTOR HORSEPOWER (HP)		7.5	7.5	5
ELECTRICAL CHAR (V/PH)		208/3	208/3	208/3
VARIABLE SPEED DRIVE		YES	YES	YES

PROJECT:
SBAC GAINESVILLE HIGH SCHOOL
BUILDING 27 HVAC RENOVATION

DESCRIPTION:
EARLY RELEASE PACKAGE #2:
HYDRONIC EQUIPMENT



DATE: 12-12-2018
SBAC #: H1710
PAGE: 1 OF 2



114 EAST 5th AVENUE
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H2E PROJECT No. **1871**

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AIR HANDLING UNIT SCHEDULE			
DESIGNATION	AHU-6W	AHU-1N	AHU-2N
AIR HANDLING UNIT DATA			
TOTAL SUPPLY AIR (CFM)	5000	4500	6400
OUTSIDE AIR (CFM)	1900	1800	160
FILTER SECTION DATA			
DAMPERS	NONE	NONE	NONE
FILTER ORIENTATION	ANGLED	ANGLED	ANGLED
TYPE OF FILTER	2" PLEATED MERV 13	2" PLEATED MERV 13	2" PLEATED MERV 13
COOLING COIL DATA - MAX 120 FPF, 10 ROWS AND MOX FLUID PRESSUR			
TOTAL COOLING CAPACITY (MBTUH)	151	142	192
SENSIBLE COOLING CAPACITY (MBTUH)	129.0	116.0	165.0
AIR ENTERING COOLING COIL (DEB F DW/ DEG F WB)	75.6/62.5	75.6/62.9	75.8/62.5
AIR LEAVING COOLING COIL (DEB F DW/ DEG F WB)	52.0/51.8	52.0/51.8	52.0/51.8
MAX AIR PRESSURE DROP AT COIL (IN W.G.)	0.75	0.75	0.75
WATER FLOW (GPM)	19	18	24
CHILLED WATER ENTERING TEMPERATURE (DEG F)	44	44	44
CHILLED WATER LEAVING TEMPERATURE (DEG F)	60	60	60
MINIMUM FACE AREA (SF)	10	9	13
RUNOUT PIPE SIZE (IN)	1 1/2	1 1/2	1 1/2
CONTROL VALVE (TYPE)	SEE SCHEDULE	SEE SCHEDULE	SEE SCHEDULE
FAN SECTION DATA			
FAN TYPE	PLUNUM	PLUNUM	PLUNUM
DRIVE TYPE	DIRECT	DIRECT	DIRECT
FAN QUANTITY (#)	1	1	1
EXTERNAL STATIC PRESSURE (INCLUDING FILTER) (IN W.G.)	2.0	2.0	2.0
MAXIMUM TOTAL STATIC PRESSURE(IN W.G.)	3.5	3.5	3.5
TOTAL FAN MOTOR HORSEPOWER (HP)	7.5	5	7.5
ELECTRICAL CHAR (V/PH)	208/3	208/3	208/3
VARIABLE SPEED DRIVE	YES	YES	YES

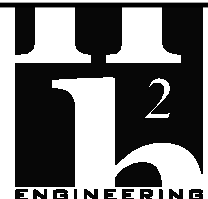
AIR HANDLING UNIT SCHEDULE			
DESIGNATION	OAU-1N	OAU-1W	OAU-4W
AIR HANDLING UNIT DATA			
TOTAL SUPPLY AIR (CFM)	3400	1900	2700
OUTSIDE AIR (CFM)	3400	1900	2700
FILTER SECTION DATA			
DAMPERS	NONE	NONE	NONE
FILTER ORIENTATION	ANGLED	ANGLED	ANGLED
TYPE OF FILTER	2" PLEATED MERV 13	2" PLEATED MERV 13	2" PLEATED MERV 13
COOLING COIL DATA - MAX 120 FPF, 10 ROWS AND MOX FLUID PRESSUR			
TOTAL COOLING CAPACITY (MBTUH)	321	179	225
SENSIBLE COOLING CAPACITY (MBTUH)	138.0	76.7	110.0
AIR ENTERING COOLING COIL (DEB F DW/ DEG F WB)	88.0/79.0	88.0/79.0	88.0/79.0
AIR LEAVING COOLING COIL (DEB F DW/ DEG F WB)	52.0/51.8	52.0/51.8	52.0/51.8
MAX AIR PRESSURE DROP AT COIL (IN W.G.)	0.75	0.75	0.75
WATER FLOW (GPM)	41	23	32
CHILLED WATER ENTERING TEMPERATURE (DEG F)	44	44	44
CHILLED WATER LEAVING TEMPERATURE (DEG F)	60	60	60
MINIMUM FACE AREA (SF)	7	6	6
RUNOUT PIPE SIZE (IN)	2 1/2	1 1/2	2
CONTROL VALVE (TYPE)	SEE SCHEDULE	SEE SCHEDULE	SEE SCHEDULE
FAN SECTION DATA			
FAN TYPE	PLUNUM	PLUNUM	PLUNUM
DRIVE TYPE	DIRECT	DIRECT	DIRECT
FAN QUANTITY (#)	1	1	1
EXTERNAL STATIC PRESSURE (INCLUDING FILTER) (IN W.G.)	1.5	1.5	1.5
MAXIMUM TOTAL STATIC PRESSURE(IN W.G.)	3.0	3.0	3.0
TOTAL FAN MOTOR HORSEPOWER (HP)	3	2	2
ELECTRICAL CHAR (V/PH)	208/3	208/3	208/3
VARIABLE SPEED DRIVE	YES	YES	YES

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