SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this and other Sections of Division 23.

1.2 SUMMARY

A. Section Includes:

1. Materials, equipment, labor, and services necessary to complete Heating, Ventilating, and Air Conditioning as shown on the Drawings, as described in the Specifications, or as inferable from the Drawings and Specifications.
2. An Air cooled chiller, chilled water system including chiller, chilled water pumps, piping, air separators, controls, wiring, conduit, auxiliaries, and appurtenances thereto.
3. Air conditioning and ventilating supply and return systems with roof or structure mounted, outdoor, air handling units complete with supply fans, return fans, motors, drives, filters, electric heating coils, air-cooled DX cooling system and piping, ductwork, dampers, controls and appurtenances thereto, with connections to the piping and ductwork systems.
4. Variable Refrigerant Flow air-conditioning system complete with supply fans, motors, variable speed drives, heat recovery units, outdoor air-cooled condensers, piping, ductwork, dampers, controls and appurtenances thereto.
5. A temperature control system with DDC/ electric-electronic temperature sensing and activating devices, dampers, damper motors, control panels, control wiring and conduit, auxiliaries and appurtenances thereto.
6. Insulation.
7. Setting of sleeves in walls, floors, and partitions.
8. Painting and identification of equipment and piping.
9. Tests, shop drawings, record drawings, and operating and maintenance instructions.
10. Testing and balancing.

B. Drawings, Division 00 Procurement and Contracting Requirements, and Division 01 Specification Sections apply to this and other Division 23 Sections.

C. Related Work Not Included in This Section:

1. The following items are specified in other Sections of these Specifications:
   a. Frames for openings.

b. Power wiring and conduit is specified in Division 26 Electrical Sections of the Specifications, unless otherwise specified herein.

1.3 BID DOCUMENTATION REQUIREMENTS

A. Compliance Review: In addition to the submittal requirements of this section, preorder bidders shall provide a Compliance Review of the Specifications and Addenda. The Compliance Review shall be a paragraph-by-paragraph review of the Specifications with the following information, “C”, “D,” or “E” marked in the margin of the original Specifications and any subsequent Addenda.

1. “C”: Comply with no exceptions.
2. “D”: Comply with deviations. For each and every deviation, provide a numbered footnote with reasons for the proposed deviation and how the intent of the Specification can be satisfied.
3. “E”: Exception, do not comply. For each and every exception, provide a numbered footnote with reasons and possible alternatives.
4. The notes associated with “D” and “E” responses shall be typewritten and submitted alongside the compliance review for review by the Engineer.

B. Unless a deviation or exception is specifically noted in the Compliance Review, it is assumed that the Bidder is in complete compliance with the plans and Specifications. Deviations or exceptions taken in cover letters, subsidiary documents, by omission or by contradiction do not release the Bidder from being in complete compliance, unless the exception or deviation has been specifically noted in the Compliance Review submitted with the Bid.

C. Provide proposed equipment schedule with time durations for product data submittal creation, fabrication, initial delivery to site, follow up deliveries, completion of final delivery, and close out documentation creation (record product data, installation, operation, maintenance, spare parts list, warranty, etc.).

1.4 PROJECT CONDITIONS AND PERFORMANCE REQUIREMENTS

A. Environmental Conditions: Systems and components shall withstand the following environmental conditions without damage or degradation of performance capability:

1. Outdoor Ambient Temperatures:
   a. Outdoor Conditions: -2.2 to 109.8 degrees FDB, -3.0 to 84.3 degrees FWB temperatures, based on ASHRAE WMO 723429 Handbook for 20-year extreme temperatures at Russellville, Arkansas, USA (nearest weather station to the project location). .
   b. International Energy Conservation Code Climate Zone for Clarksville, Arkansas area is 3A.
2. Relative Humidity: 0 to 80 percent, non-condensing.
3. Site Altitude: System and equipment shall be suitable for an altitude of 500 feet above sea level without affecting their performance.

B. Seismic Restraint Loading Design Criteria: The equipment and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and the Structural Engineer's Design Criteria indicated on Sheet S-001

1. The term "withstand" means "the system shall remain in place without separation of any parts when subjected to the seismic and wind forces specified." The system shall be fully operational after the seismic event.
2. Seismic Design Criteria: For building structures and as required by ASCE/SEI Standard 7 (latest version), Chapter 24:
   a. Site Class as Defined in the IBC: C.
   b. Seismic Design Category = B.
   c. Assigned Seismic Use Occupancy or Building Risk Category as Defined in the IBC: II
   d. Component Importance Factor: $I_S = 1.0$
   e. Short Period Site Coefficent $F_a = 1.3$
   f. 1-Second Period Site Coefficient $F_v = 1.5$
   g. Maximum Considered Earthquake Spectral Response Acceleration at Short Periods (0.2 Second): $S_S = 0.23g$.
   h. Maximum Considered Earthquake Spectral Response Acceleration at 1.0-Second Period: $S_1 = 0.11g$.
   i. Design Spectral Response Acceleration at Short Periods (0.2 Second): $S_{DS} = 0.20$
   j. Design Spectral Response Acceleration at 1.0-Second Period: $S_{D1} = 0.11$.
   k. Response Modification Factor: R = 3.0.
3. Deflection:
   a. Roof Members: Total Load Maximum Allowable Deflection: L/240.
   b. Above Grade Floor Members: Total Load Maximum Allowable Deflection: L/240.
4. Mechanical Contractor Responsibility: Provide flexible connections in runs of pipe and ductwork where they cross building expansion joints, seismic joints, or where they are subject to structural deflection and/or drift. Flexible connections shall be provided where adjacent sections of pipe and ductwork are supported by different structural elements and where they terminate to equipment that is anchored or supported to a different structural element. Contractor shall coordinate with the structural and/or architectural drawings in order to provide the required flexible connections.
5. Mechanical Contractor Responsibility - Delegated design: The Contractor shall be responsible for designing the required seismic and wind load restraints, vibration isolators, anchors, supports, and supplemental steel for a complete installation of the mechanical systems. The design calculations shall be performed, signed and sealed by a qualified, licensed, professional engineer, and shall be submitted to the design professionals for review.

C. Sound Level Criteria: The local zoning regulations do not include a noise limitation at the property line for this project location.

D. 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.

E. ASHRAE Compliance:

1. Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."
2. Applicable requirements in ASHRAE/IES 90.1.

1.5 WORKMANSHIP

A. Perform operations necessary for the proper installation and operation of systems.

B. Work performed shall be first class in every respect. The work shall be performed by mechanics skilled in their respective trades, who shall be under the supervision of competent persons.

C. Work that is slipshod, poorly laid out, not aligned, or that is not consistent with the requirements generally accepted in the trade for "first class work" will not be acceptable.

D. In addition to the materials specified elsewhere, other miscellaneous items necessary for the completion of the work shall be furnished and installed by the Contractor to the extent that systems are complete and operative.

1.6 REGULATIONS AND CERTIFICATES

A. Install work required by the Drawings and Specifications to comply with applicable building laws, plumbing laws, regulations and ordinances of the state and local laws and regulations as may apply, except where these requirements are exceeded by the Drawings and Specifications.

B. Changes in the arrangement of the work, either before or after installation, to suit conditions in the building or the work of other trades, and changes required by agencies having jurisdiction shall be made without extra charge, unless the charges are in consequence of changes made by the Owner.

C. Deliver to the Owner an Underwriters' Certificate of Approval covering electrical work performed in connection with the heating, ventilating, and air conditioning work, in addition to other certificates that may be issued by authorities having jurisdiction.

1.7 FACILITY ACCESS

A. The access into the project site for Contractor employees, equipment, and materials furnished under this Contract shall be through openings and entrances designated by Owner.

1.8 EXPEDITING THE WORK

A. Take field measurements to verify dimensions indicated on the Drawings. Coordinate the work with other trades to cause no delay in the work and to minimize cutting and patching. Report any discrepancies or interference immediately to the Owner.

B. Cooperate with other trades on the project. Contractor is responsible for delivery of materials and equipment and for the installation of work under this Division, at a time and in a manner that will ensure that there will be no delay in the overall project construction schedule.

C. Upon award of Contract, provide a graphic schedule detailing the entire HVAC installation. The schedule shall be prepared using Microsoft Project. Cooperate with the Contractor and other trades to integrate the HVAC schedule with the overall project schedule. The schedule shall include the following:

1. Include line items indicating each task.
2. Identify linked tasks.
3. Indicate the critical path.
4. Indicated percent complete, start, duration times and completion dates for each task.
5. Group tasks into summary groups as applicable.
6. Indicate milestones for completion dates and delivery dates.
7. Indicate Owner- established “quiet times” as non-working times.

D. Update the project schedule for each project meeting or every two weeks whichever is more often.

1.9 PROTECTION OF THE WORK

A. Provide temporary covering and do work required to protect work, materials, machinery and equipment from damage, including damage from moisture.

B. After the work is complete, clean equipment, piping, and machinery.

1.10 SUBMITTALS

A. General: Submit the following according to Section 01 33 00, Submittal Procedures.

B. Equipment Submittal Documentation Requirements:

1. The equipment product data, performance data, shop drawings, installation, operation, maintenance, service, testing and training, and record as-built documentation referred to within shall be submitted to the Owner and Engineer in a searchable Adobe Acrobat or Microsoft Word format electronically.
2. Submittals shall be presented in a logical and clear format, contain a cover page and table of content, marked and/or highlighted to identify project specific data. Unedited, general data sheets will not be accepted.

3. The Drawings referenced within shall be submitted in REVIT and AutoCAD format electronically. Simple, one-line drawings/diagrams may be submitted in AutoCAD or Microsoft Visio format electronically.

C. Provide a cover page for each submittal and include the following information:
   1. Submittal Date.
   2. Project Title and Location.
   3. Project Team Names and Addresses (Owner, Engineer, and Construction Manager).
   4. Project Team Reference Numbers (Owner, Engineer, and Construction Manager).
   5. Supplier's Name, Address, and Contact Information.
   6. Manufacturer's Name, Address, and Contact Information.
   7. Submittal Package Number.
   8. Applicable Specification Section, Article Number, and Drawing Number.

D. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, color chart, and furnished specialties and accessories.

E. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components and location and size of each field connection.
   1. Wiring Diagrams: Detail wiring for power, signal and control systems and differentiate between Manufacturer installed and field installed wiring.
   2. Equipment Support Details: Detail fabrication including anchorages and attachments to structure or floor stands and to supported ductwork or equipment. Document internal fan vibration isolation including vibration isolators, flexible connections, auxiliary motor slides, or rails where applicable. Provide Manufacturer's product literature for applied equipment like variable frequency drives and auto transfer switches.
   3. Document access requirements around other work, including working clearances to mechanical controls and electrical equipment.

F. Seismic Qualification Data: Certificates, for equipment, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

G. Warranty Information
   1. Clearly state in the submittal the duration of the parts and labor warranty being provided directly by the manufacturer or manufacturer's representative, and

indicate the warranty is applicable to the location where the equipment shall ultimately operate at.

2. Provide a generic copy of the manufacturer's warranty certificate as part of the initial submittal. Provide the actual warranty certificate as part of the project closeout phase.

H. Electronic Submittal Package File Naming Convention: Specification Section Number, Project Name (ARK01), Abbreviated Description/Title of Submittal

1. Examples: 23 05 23 - ARK01 - Valves.pdf.

I. Submit copies of manufacturer's shop drawings and descriptive literature, together with the manufacturer's installation, operating and maintenance instructions, for equipment to be incorporated in the work, including temperature control diagrams and wiring diagrams, and obtain approval before proceeding with the installation.

J. 14 days after the Contract is awarded, submit a complete list of materials, devices, and equipment to be incorporated in the work. The list shall include manufacturers' names, catalog numbers, description of material, equipment, devices, etc. proposed to be utilized on this project only. Identify on the list the proposed application of the materials and equipment. The list shall not preclude the necessity of submitting shop drawings for the items included herein.

K. Each item shall be clearly identified as to the proposed application. Where items of specified material and equipment are assembled to make up a larger apparatus, submit the manufacturer's or fabricator's assembly shop drawings. Such drawings shall include dimensions and essential details of arrangement, construction, assembly, and connections. Wiring diagrams for control systems furnished under this Section shall also be submitted. When directed by the Owner, submit in approved form for the record a Certificate of Compliance with a cited code or standard for the materials and equipment designated. Such certificates may be accepted in lieu of samples. Any materials, fixtures or equipment submitted that are not in accordance with the Specifications requirements may be rejected. Any shop drawings marked "Make Correction Noted", "Revised and Resubmit" or "Rejected" shall be revised and resubmitted until marked with "No Exception Taken".

L. When indicated in these Specifications or on the Drawings, or when directed by the Owner, installation drawings shall be submitted. Submit installation drawings to the Owner for comment when an installation condition or problem arises which the Contractor wishes the Owner to review. Installation drawings submitted for review will be considered and treated as shop drawings and the requirements pertaining to shop drawings shall govern.

M. Submit copies of Contractor-prepared shop drawings at 1/4 inch scale or larger showing ductwork and piping mains, including connections to equipment, and equipment layouts and obtain A/E review before proceeding with the work. Accurately dimension shop drawings so that ductwork, piping, and equipment clears structural members and other work incorporated in the project. Take shop drawing measurements at the project site.

N. Submit copies of Contractor-prepared shop drawings at 1/2 inch scale or larger showing ductwork, fan casings and air handling equipment and other congested areas and obtain

acceptance before proceeding with the work. Accurately dimension shop drawings so that ductwork clears structural members and other work incorporated in the project. Take the shop drawing measurements at the building.

O. Submit the following shop drawings, manufacturer's brochures, manufacturer's installation and operating instructions, etc. before proceeding with the work:

1. Pipe and fittings (1)
2. Pipe hangers and supports (1)
3. Valves (1) (2)
4. Thermometers (1) (2)
5. Pressure gages (1) (2)
6. Air vent valves (1) (2)
7. Strainers (1) (2)
8. Circuit balancing valves (1) (2)
9. Computer room air conditioning units (1) (2)
10. Humidifiers (1) (2)
11. Air devices (1)
12. Flexible connectors (1)
13. Insulation (1)
14. Temperature control system (1) (2) (3)
15. Piping identification (1)
16. Equipment identification (1)
17. System identification (1)
18. Valve tags, schedules, and plans (1)
19. Piping system diagrams (1)
20. Air and water balancing and testing (1)

Legend

(1)	Indicates manufacturer's certified print required.
(2)	Indicates manufacturer's operating, maintenance and lubrication manual required.
(3)	Indicates equipment which takes time to manufacture. Submit shop drawings for these items after Contract is awarded per the Contract schedule.

P. Shop drawings for devices shall be submitted within 30 calendar days from Award of Contract. If equipment is not submitted within this time and in accordance with the requirements for shop drawings and cannot be furnished in time to meet the construction schedule, provide temporary equipment that will perform the equivalent function, for the duration of the time until the specified equipment has arrived. Remove the temporary equipment and install the specified equipment at the Owner’s convenience and at no additional cost to the Owner.

1.11 CLOSE OUT SUBMITTAL DATA

A. The close out documentation shall include submittals, shop drawings, installation procedures, operations & maintenance (O&M) manuals as follows.
   1. Close out documentation submissions:
      a. Initial Submittal: Provide searchable Adobe Acrobat (pdf) format submittal for the Owner and Engineer to review electronically. If desired by the Owner, provide one (1) hard copy for the Owner to review.
      b. Final Submittal: Upon approval of the initial submittal, provide electronic file to the Owner and Engineer, and provide one (1) hard copy to the Owner.
   2. Electronic submittals shall also be provided in portable document format (PDF). Submit a combined PDF document that is word-searchable (not scanned) which shall include bookmarks that match the table of contents of the hard copy submittal. Alternatively, if multiple PDF files are submitted, file names shall match the table of contents. Submittals consisting of multiple PDF files with non-descript file names may be disqualified from bid and/or rejected.
   3. Hard copy submittals shall be in bound tabular format, with dividers and tabs clearly indicating relevant sections of the submittal.
   4. Shop drawings shall be submitted in either AutoCAD or REVIT format electronically.

B. Submit Operations and Maintenance (O&M) Manuals for system and components as specified in the following Sections:
   1. 01 77 00 Closeout Procedures
   2. 01 78 23 Operation and Maintenance Data

C. Additionally, refer to the below Specifications for other general requirements:
   1. 01 78 39 Project Record Documents
   2. 01 79 00 Systems Demonstrations and Training
   3. 01 78 30 Warranties and Bonds
   4. 01 91 13 Commissioning Requirements

D. In addition to requirements included in the Sections referenced above, include the following:
   1. Contact information for service work.
   2. List of special tools recommended to be stored at the site for ready access.
   3. Detailed operating instructions for both normal and abnormal (emergency) conditions.
   4. Copy of approved submittal and shop drawing.
   5. Document indicating the recommended service intervals.
   6. Field Test and Observation Reports: Indicate and interpret test results for compliance with performance requirements.
   7. Complete list of user access credentials, including usernames and passwords for each level of access to which the Owner is entitled.

8. Where applicable, complete list of relays, meters, etc. with configurations both in native format and tabular format.
9. Submit soft copies of the firmware for the items in the firmware.

1.12 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Furnish to the Owner four sets of written operating, maintenance and lubrication instructions for the installed systems and equipment. Instructions shall include copies of the designated approved shop drawings, manufacturer's descriptive data, control diagrams, wiring diagrams, performance test data, test and balance reports and installation and operating instructions as specified.

B. Submit the above instructions, charts, etc. to the Owner as a rough draft and after the required corrections are made, furnish one electronic copy, suitably indexed and identified, to the Owner.

C. Instruct the Owner's designated operating personnel in the proper operation and maintenance of the equipment as well as the operation and maintenance of the controls for the various systems in the building. Informal or un-witnessed instructions, or instructions to non-designated personnel will not be acceptable. In addition to the instruction periods specified elsewhere, furnish instruction for a minimum of 16 working days straight time (not necessarily consecutive). Prior arrangements for instruction periods shall be made with the Owner.

D. Video of instruction period, as described in the paragraph above, in DVD format, hands-on training sessions and classroom instruction periods shall be as directed by the Owner. No special effects are required.

1.13 RECORD DRAWINGS

A. Maintain an accurate record set of as-built drawings of any deviations in work as actually installed from the work as indicated on the design Drawings. Utilize the contract design Drawings for marking up any deviations to the Drawings. Keep the record current and available at the site for inspection. Refer to Division 01 Specification Sections for specific requirements relating to record drawings.

B. Upon completion of the work, and before final payment is authorized, deliver to the Architect marked prints of the Contract Drawings showing to scale the work, including equipment, controls, piping, etc. as actually installed.

1.14 GUARANTEE

A. Guarantee design circulation throughout the air and water systems.

B. Guarantee that the capacity of equipment installed meets Specification requirements.

C. Guarantee that the new systems will operate without excessive noise and vibration. Noise and vibration levels defined by local AHJ and owner.

D. Obtain from the various manufacturers or vendors standard guarantees or warranties for their particular equipment or components and deliver them to the Owner.

1.15 EQUIPMENT GROUNDING

A. Furnish equipment, panels, and devices (except motors) which require electrical connections with a factory-welded (prior to finish painting) ground lug in a concealed and accessible location.

1.16 FINAL INSPECTION

A. Conduct a final inspection of work installed under this Division of the Specification after the installation has been completed; the testing and balancing hereinafter specified has been performed; and test and balance reports have been submitted to the Owner.

B. During the conduct of the final inspection, have a representative of the temperature controls manufacturer present and a representative of the manufacturers of other equipment as directed by the Owner.

C. Demonstrate, to the satisfaction of the Owner, that the systems installed meet Specification requirements and that the capacities and performances of the equipment meet schedule requirements. Make changes, modifications, and adjustments to the installed systems, as directed by the Owner, to meet Specifications requirements, at no additional cost to the Owner.

1.17 COMMISSIONING

A. Include in the Bid a minimum testing period of 30 working days wherein aspects of the HVAC systems specified herein will be tested in accordance with detailed test standards issued by the Owner. Coordinate schedule with the Owner’s third party commissioning agent for testing of equipment and controls systems.

B. Provide sufficient technical personnel and instruments to perform the tests as directed by the Owner.

C. The testing period specified herein is in addition to other testing or instruction periods included elsewhere in these Specifications.

D. Perform pre-commissioning checks for items included in the test procedures. Correct deficiencies discovered during these checks and retest in accordance with the applicable contract requirements until deficiencies are corrected. Pre-commissioning checks are not included in the testing period working days specified above.

E. Perform the pre-commissioning check and functional performance tests for equipment furnished under the HVAC Sections of the Specifications. Perform testing and verification required during the pre-commissioning phase. Requirements in related Sections are independent of the requirements of this Section and are not used to satisfy the requirements specified in this Section. Provide the materials, services and labor required to perform the pre-commissioning checks and functional performance tests. Abort a pre-commissioning check or functional performance test if any system deficiency

prevents the successful completion of the test or if any participating commissioning team member whose participation is required is not present for the test. Reimburse the Owner for the costs associated with effort lost due to tests that are aborted. These costs include salary, travel costs, and per diem (where applicable).

F. Begin functional performance tests only after the pre-commissioning checks have been successfully completed. Perform tests that prove the modes of the sequence of operation and verify other relevant contract requirements in accordance with the test standards issued by the Owner. Begin tests with equipment or components and progress through subsystems to complete systems. Upon failure of any functional performance test, correct the deficiencies in accordance with the applicable Contract Documents. Repeat the test until it has been completed with no errors.

G. Additional working days required to complete testing, because of tests which were aborted or not completed due to testing deficiencies which require additional testing beyond the testing period specified in paragraph above, shall be provided by the Contractor at no additional cost to the Owner.

H. Include in the bid an additional five (5) working days to provide assistance during the integrated systems test.

1.18 QUALITY CONTROL AND ACCEPTANCE TESTING

A. Provide quality control performance and acceptance tests for the systems, devices, and equipment installed or wired under this Division. Tests shall be performed to the satisfaction of the Owner and the Owner’s representative. For acceptance testing requirements, refer to Section 01 40 00, Quality Requirements for general quality control requirements.

1.19 SHUTDOWNS AND PREMIUM COSTS

A. The Contractor shall be present for and demonstrate the function of each piece of installed equipment.

B. Include costs for performing specified out-of-hours work and specified premium time work in the base bid price.

C. Perform work under this Section which may cause interference with the Owner's operation in such a manner and when is approved by the Owner.

1.20 QUALITY ASSURANCE

A. Qualify welding processes and operators for structural steel according to AWS D1.1 “Structural Welding Code-Steel”.

B. Qualify welding processes and operators for piping according to ASME “Boiler and Pressure Vessel Code”, Section IX, “Welding and Brazing Qualifications”.

1. Comply with provisions of ASME B31 series “Code for Pressure Piping”.

2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.

1.21 DELIVERY, STORAGE AND HANDLING

A. Deliver ductwork, pipe, and tubes with shop or factory applied end caps. Maintain end caps through shipping, storage and handling to prevent pipe end damage and entrance of dirt, debris, and moisture.

B. Protect stored equipment, ductwork, pipes and tubes from moisture and dirt. When stored inside, do not exceed the structural capacity of the floor.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. The Contractor shall receive and store spare parts and attic stock items, furnished by the Owner and items provided by the Contractor, until the Substantial Completion date, then turnover items to the Owner with an itemized list and transmittal. Submit itemized spare parts and attic stock list and transmittal to the Design Professionals for review.

1.22 SEQUENCING AND SCHEDULING

A. Coordinate HVAC equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for HVAC installations.

C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

D. Sequence, coordinate, and integrate installations of HVAC materials and equipment for efficient flow of the work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

E. Coordinate connection of electrical services.

F. Coordinate connection of HVAC systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

G. Coordinate requirements for access panels and doors where HVAC items requiring access are concealed behind finished surfaces.

H. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

1.23 DRAWINGS AND SPECIFICATIONS

A. The Mechanical Drawings are to be considered schematic only and do not necessarily show the exact location and details of the work to be installed. It shall be the

responsibility of the Contractor to provide the work in conformity with the requirements of these Specifications, the applicable codes, regulations and standards, and the best trade practices meeting with the approval of the Owner. If any departures from the Drawings are deemed necessary, details of such departures and the reasons therefore shall be submitted immediately to the Owner and Engineer for approval. If any conflicts or discrepancies are found to exist on the Drawings, in the Specifications or between the Drawings and the Specifications, assume the most expensive option and include such costs in his Bid. It shall be understood that the Owner reserves the right to change the location of equipment and apparatus to a reasonable extent as facility conditions may dictate, without extra cost to the Owner.

B. Locations of piping, ductwork, panels, devices, and other equipment are correct, but are subject to such revision as may be found necessary or desirable at the time work is installed to meet field conditions, to coordinate with modular requirements of ceilings, to simplify work, or for other legitimate causes.

C. The Mechanical Drawings show general arrangement of piping, ductwork, equipment and appurtenances and shall be followed as closely as actual building construction and work of other trades will permit. Verify dimensions in field and measure off building construction for locations of equipment and devices. The Mechanical work shall conform to requirements shown on each trade's Drawings. Architectural layout on Construction Drawings shall take precedence over Architectural layout on the Mechanical Drawings. Because of the small scale of the Mechanical Drawings, it is not possible to indicate every offset, fitting, and accessory which may be required. Investigate structural and finish conditions affecting work and arrange work accordingly, providing the accessories required to meet such conditions.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. General:

1. The equipment shall be the capacity and types specified and as shown on the Equipment Schedule on the Drawings and shall be the listed manufacturers and model numbers.
2. Matching Equipment for Build Out Projects: The desired preference is to match the existing equipment manufacturers utilized in the Building.

B. Equipment, materials, controls, instrumentation, and accessories shall comply with applicable State, city and local codes and laws. In addition, materials, equipment, and accessories shall comply with the National Standards of ASTM, ANSI, AWWA, NFPA, ASHRAE and others.

C. Equipment Selection: Equipment of greater or larger power, dimensions, capacities and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases and equipment spaces are increased. No additional costs will be approved for these changes if larger equipment is approved. If minimum energy ratings or efficiencies of

the equipment are specified, the equipment shall meet the design and commissioning requirements.

2.2 MATERIAL

A. Provide the material required for a complete and proper installation shall be as specified.

B. Matching Material for Build Out Projects: The desired preference is to match the existing material manufacturers utilized in the Building.

PART 3 - EXECUTION

3.1 GENERAL

A. Inspection: Prior to execution of work in this Division, carefully inspect installed work of other trades and verify that installed work is complete to the point where installation of work in this Division may properly commence. Verify that the work of this Division is completed in accordance with pertinent codes and regulations, reviewed shop drawings, and manufacturer's recommendations.

B. Discrepancies: In the event of discrepancy, immediately notify the Owner. Do not proceed in areas of discrepancy until discrepancies have been fully resolved.

3.2 INSTALLATION OF EQUIPMENT

A. Locations: Install equipment in locations shown on shop drawings, except where specifically otherwise approved on the job by the Owner.

B. The equipment and devices shall be installed in strict accordance with the manufacturer's written instructions.

C. Interferences: Avoid interference with structure, and with the work of other trades, preserving adequate headroom and clearing doors and passageways to the approval of the Owner.

D. Inspection: Check each piece of equipment in the system for defects, verifying that parts are properly furnished and installed, that items function properly, and that adjustments have been made.

E. Fabricate, test, assemble and install material, equipment and systems in accordance with the requirements of the following:

1. American National Standards Institute (ANSI).
2. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE).
3. American Society of Mechanical Engineers (ASME).
4. National Fire Protection Code (NFPA).
5. Occupational Safety and Health Administration (OSHA).

6. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
7. Underwriters' Laboratories, Inc. (UL).

3.3 CLOSING-IN OF UNINSPECTED WORK

A. General: Do not allow or cause work of this Division to be covered up or enclosed until it has been observed and found acceptable by the Design Professional and by other authorities having jurisdiction.

B. Uncovering: Should any of the work of this Section be covered up or enclosed before it has been completely observed and found acceptable, the Contractor shall uncover such work per the request of the Design Professional, Owner, or Authority Having Jurisdiction. After the work has been completely inspected, tested and approved, provide materials and labor necessary and make repairs necessary to restore the work to its original and proper condition at no additional cost to the Owner.

3.4 COOPERATION WITH OTHER TRADES

A. Cooperate with other trades in order that systems in the work may be installed in the best arrangements.

B. Coordinate as required with other trades to share space in common areas and to provide maximum access to each system.

3.5 CLEANING

A. Remove construction dirt, debris, tools, etc. from site and clean equipment inside and out prior to Level-4 commissioning.

3.6 COMPLETENESS

A. It is the intent of these Specifications to provide a complete system. Completeness shall mean that material and equipment has been installed and adjusted for heating and cooling and that, in the opinion of the Owner, the material and equipment is operating as designed. This includes installation of cooling media (i.e. water) as called out on the equipment schedules.

END OF SECTION