



**TOPEKA METRO**

**REQUEST FOR BIDS  
QSS HVAC Equipment Upgrade  
TO-25-03**

**Appendix 1  
Engineer's HVAC Written  
Specifications**

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**SECTION 230100 - HVAC PROVISIONS****1. PART 1 - GENERAL****1.1. RELATED DOCUMENTS**

All contract documents including drawings, alternates, addenda and modifications and general provisions of the Contract, including General and Supplementary Conditions and all other Division Specification Sections, apply to work of this section. All preceding and following sections of this specification division are applicable to the Mechanical Contractor, all sub-contractors, and all material suppliers.

**1.2. SCOPE OF WORK**

This DIVISION requires the furnishing and installing of complete functioning Heating, Ventilating, and Air Conditioning systems, and each element thereof, as specified or indicated on Drawings or reasonably inferred, including every article, device or accessory reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the Work include materials, labor, supervision, supplies, equipment, transportation, and utilities.

Refer to Architectural, Structural, Mechanical, and Electrical Drawings and all other contract documents and to relevant equipment drawings and shop drawings to determine the extent of clear spaces and make all offsets required to clear equipment, beams and other structural members to facilitate concealing piping and ductwork in the manner anticipated in the design.

**1.3. SPECIFICATION FORM AND DEFINITIONS**

The Engineer indicated in these specifications is Pearson Kent McKinley Raaf Engineers LLC. 2933 SW Woodside Dr, Suite C, Topeka, KS, 66614, PHONE 785-273-2447, FAX 785-273-0456, EMAIL scott.mckinley@pkmreng.com.

Contractor, wherever used in these specifications, shall mean the Company that enters into contract with the Owner to perform this section of work.

When a word, such as "proper", "satisfactory", "equivalent", and "as directed", is used, it requires the Architect-Engineer's review. "Provide" means to furnish and install in a satisfactory working condition.

**1.4. QUALIFICATIONS**

The contractors responsible for work under this section shall have completed a job of similar scope and magnitude within the last 3 years. The contractors shall employ an experienced, competent and adequate work force licensed in their specific trade and properly supervised at all times. Unlicensed workers and general laborers shall be adequately supervised to insure competent and quality work and workmanship required by this contract and all other regulations, codes and practices. At all times the contractors shall comply with all applicable local, state and federal guidelines, practices and regulations. Contractor may be required to submit a statement of qualifications upon request before any final approval and selection. Failure to be able to comply with these requirements is suitable reason for rejection of a bid.

**1.5. LOCAL CONDITIONS**

The contractor shall visit the site and determine the existing local conditions affecting the work required. Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

### 1.6. CONTRACT CHANGES

Changes or deviations from the contract documents; including those for extra or additional work must be submitted in writing for review of Architect-Engineer. No verbal change orders will be recognized.

### 1.7. LOCATIONS AND INTERFERENCES

Locations of equipment, piping and other mechanical work are indicated diagrammatically by the mechanical drawings. The Contractor shall determine the exact locations on site, subject to structural conditions, work of other Contractors, and access requirements for installation and maintenance to approval of Architect-Engineer. Provide additional piping and ductwork offsets as required at no additional cost.

Study and become familiar with the contract drawings of other trades and in particular the general construction plans and details in order to obtain necessary information for figuring installation.

Cooperate with other contractors and install work in such a way as to avoid interference with their work. Minor deviations, not affecting design characteristics, performance or space limitation may be permitted if reviewed prior to installation by Architect-Engineer.

Any pipe, ductwork, equipment, apparatus, appliance or other item interfering with proper placement of other work as indicated on drawings, specified, or required, shall be removed, relocated and reconnected without extra cost. Damage to other work caused by this Contractor, the Subcontractor, or workers shall be restored as specified for new work.

Do not scale mechanical and electrical drawings for dimensions. Contractor shall accurately layout work from the dimensions indicated on the Architectural drawings unless they are found to be in error.

### 1.8. PERFORMANCE

Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification division.

The Contractor warrants to the Owner and Architect-Engineer the quality of materials, equipment, workmanship and operation of equipment provided under this specification division for a period of one year from and after completion of building and acceptance of mechanical systems by Owner.

### 1.9. WARRANTY

The Contractor warrants to the Owner and Architect-Engineer that upon notice from them within a one year warranty period following date of acceptance, that all defects that have appeared in materials and/or workmanship, will be promptly corrected to original condition required by contract documents at Contractor's expense. The above warranty shall not supersede any separately stated warranty or other requirements required by law or by these specifications.

### 1.10. ALTERNATES

Refer to General Requirements for descriptions of any alternates that may be included.

### 1.11. MATERIALS, EQUIPMENT AND SUBSTITUTIONS

The intent of these specifications is to allow ample opportunity for Contractor to use his ingenuity and abilities to perform the work to his and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required. Material and equipment installed under this contract shall be first class quality, new, unused and without damage.

In general, these specifications identify required materials and equipment by naming one or more manufacturer's brand, model, catalog number and/or other identification. The first named manufacturer or product is used as the basis for design; other manufacturers named must furnish products consistent with specifications of first named product as determined by Engineer. Base bid proposal shall be based only on materials and equipment by manufacturers named, except as hereinafter provided.

Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to Architect-Engineer for review prior to procurement.

Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color as determined by Architect-Engineer whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by two copies of complete descriptive and technical data including manufacturer's name, model and catalog number, photographs or cuts, physical dimensions, operating characteristics and any other information needed for comparison.

If the Contractor wishes to incorporate products other than those named in the Base Bid Specifications they shall submit a request for approval of equivalency in writing no later than (10) ten calendar days prior to bid date. Substitutions after this may be refused at Engineers option. Equivalents will ONLY be considered approved when listed by addendum.

In proposing a substitution prior to or subsequent to receipt of bids, include in such bid the cost of altering other elements of this project, including adjustments in mechanical or electrical service requirements necessary to accommodate such substitution.

Within 10 working days after bids are received, the apparent low bidder shall submit to the Architect-Engineer for approval, three copies of a list of all major items of equipment they intend to provide. Within 30 working days after award of Contract, Contractor shall submit shop drawings for equipment and materials to be incorporated in work, for Architect-Engineer review. Where 30-day limit is insufficient for preparation of detailed shop drawings on major equipment or assemblies, Contractor shall submit manufacturer's descriptive catalog data and indicate date such detailed shop drawings will be submitted along with manufacturer's certification that order was placed within 30 working day limit.

#### 1.12. ELECTRONIC PLAN FILES

Electronic files of the contract documents may be available from the Engineer to successful bidders and manufacturers for a fee of \$50 per sheet, \$100 minimum and \$25 email/shipping charge. A release of liability form will be required along with payment prior to release of files.

#### 1.13. OPENINGS, ACCESS PANELS AND SLEEVES

This Contractor shall include the installation of all boxes, access panels and sleeves for openings required to install this work, except structural openings incorporated in the structural drawings. Sleeves shall be installed for all pipes passing through structural slabs and walls. Contractor shall set and verify the location of sleeves that pass through beams, as shown on structural plans. All floor and wall penetrations shall be sealed to meet fire-rating requirements.

#### 1.14. EXTENT OF CONTRACT WORK

Provide mechanical systems indicated on drawings, specified or reasonably implied. Provide every device and accessory necessary for proper operation and completion of mechanical systems. In

no case will claims for "Extra Work" be allowed for work about which Contractor could have been informed before bids were taken.

Contractor shall become familiar with equipment provided by other contractors that require mechanical connections and controls.

Electrical work required to install and control mechanical equipment, which is not shown on plans or specified under Division 26, shall be included in Contractor's base bid proposal. All automatic temperature control devices shall be mounted as indicated in automatic temperature control section of specifications.

The cost of larger wiring, conduit, control and protective devices resulting from installation of equipment which was not used for basis of design as outlined in specifications shall be paid for by Mechanical Contractor at no cost to Owner or Architect-Engineer.

Contractor shall be responsible for providing supervision to Electrical Contractor to insure that required connections, interlocking and interconnection of mechanical and electrical equipment are made to attain intended control sequences and system operation.

Furnish four complete sets of electrical wiring diagrams to Architect-Engineer to be included in the maintenance manuals and three complete sets to Electrical Contractor. Diagrams shall show factory and field wiring of components and controls. Control devices and field wiring to be provided by Electrical Contractor shall be clearly indicated by notation and drawing symbols on wiring diagrams.

Contractor shall obtain complete electrical data on mechanical shop drawings and shall list this data on an approved form that shall be presented monthly or on request, to Electrical Contractor. Data shall be complete with wiring diagrams received to date and shall contain necessary data on electrical components of mechanical equipment such as HP, voltage, amperes, watts, locked rotor current to allow Electrical Contractor to order electrical equipment required in his contract.

#### 1.15. WORK NOT INCLUDED IN CONTRACT

Consult Division 26 of specifications for work to be provided by Electrical Contractor in conjunction with installation of mechanical equipment.

#### 1.16. CODES, RULES AND REGULATIONS

Provide Work in accordance with applicable codes, rules and regulations of Local and State, Federal Governments and other authorities having lawful jurisdiction.

Conform to latest editions and supplements of following codes, standards or recommended practices.

##### 1.16.1. CODES:

2021 International Building Code

2021 International Energy Conservation Code as amended by City.

2021 International Fire Code

2015 Uniform Mechanical Code

2018 Uniform Plumbing Code

2023 National Electrical Code

2010 Americans with Disabilities Accessibility Guidelines (ADAAG).

2015 Life Safety Code

**1.16.2. SAFETY CODES:**

National Electrical Safety Code Handbook H30 - National Bureau of Standards.

Occupational Safety and Health Standard (OSHA) - Department of Labor.

**1.16.3. NATIONAL FIRE CODES:**

NFPA No. 13 Standard for the installation of Sprinkler Systems

NFPA No. 14 Standard for the installation of Standpipe and Hose Systems

NFPA No. 54 Gas Appliance & Gas Piping Installation

NFPA No. 70 National Electrical Code

NFPA No. 89M Clearances, Heat Producing Appliances

NFPA No. 90A Air Conditioning and Ventilating Systems

NFPA No. 91 Blower & Exhaust System

NFPA No. 101 Life Safety Code

NFPA No. 204 Smoke & Heating Vent Guide

**1.16.4. UNDERWRITERS LABORATORIES INC:**

All materials, equipment and component parts of equipment shall bear UL labels whenever such devices are listed by UL.

**1.16.5. MISCELLANEOUS CODES:**

ANSI A117.1 - Handicapped Accessibility, ASHRAE 90.1 – 1989, Kansas State Boiler Code, Americans with Disabilities Act (ADA)

**2. PART 2 – PRODUCTS**

Not Used

**3. PART 3 - EXECUTION****3.1. SUBMITTALS**

Contractor shall provide the following submittal sections that apply to this project:

HVAC AIR SIDE EQUIPMENT:

Air handling units, Condensing units

SYSTEM TESTING & BALANCING:

Balance Report

**3.2. OPERATING AND MAINTENANCE INSTRUCTIONS (O & M MANUALS)**

Submit with shop drawings of equipment, four copies of installation, operating, maintenance instructions, and parts lists for equipment provided. Equipment manufacturer shall prepare instructions.

Keep in safe place, keys and wrenches furnished with the equipment provided under this contract. Present to the Owner and obtain a receipt for them upon completion of project.

Prepare a complete brochure, covering systems and equipment provided and installed under this contract. Submit brochures to Architect-Engineer for review before delivery to Owner. Brochures shall contain following:

- Certified equipment drawings/or catalog data with equipment provided clearly marked as outlined above.
- Complete installation, operating, maintenance instructions and parts lists for each item of equipment.
- Special emergency operating instructions with a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to various parts of mechanical system.
- Record Set Drawings: The Contractor shall mark up a set of contract documents during construction all changes and deviations including change orders. These will be delivered to Architect-Engineer at the end of the project. After the originals are changed to reflect the blue line set, a copy shall be included in the brochure.

Provide brochures bound in three-ring binders with metal hinge. Reinforce binding edge of each sheet of loose-leaf type brochure to prevent tearing from continued usage. Clearly print on label insert of each brochure:

- Project name and address.
- Section of work covered by brochure, i.e., "Heating, Ventilating and Air Conditioning", and "Plumbing", etc.

### 3.3. CUTTING AND PATCHING

Contractor shall do cutting and patching of building materials required for installation of work herein specified. Do not cut or drill through structural members including wall, floors, roofs, and supporting structure, without the Architect's and Structural Engineer's approval and in a manner approved by them.

Make openings in concrete with concrete hole saw or concrete drill. Use of star drill or air hammer for this work will not be permitted.

Patching shall be by the contractors of the particular trade involved and shall meet approval of Architect-Engineer. Damage to building finishes, caused by installation of mechanical work shall be repaired at Mechanical Contractor's expense to approval of Architect-Engineer.

### 3.4. SETTING, ADJUSTMENT AND EQUIPMENT SUPPORTS

Work shall include mounting, alignment and adjustment of systems and equipment. Set equipment level on adequate foundation and provide proper anchor bolts and isolation as shown, specified or required by manufacturers in installation instructions. Level, shim and grout equipment bases as recommended by manufacturer. Mount motors, align and adjust drive shafts and belts according to manufacturer's instructions.

Equipment failures resulting from improper installation or field alignment shall be repaired or replaced by Contractor at no cost to Owner.

Provide floor or slab mounted equipment with 3-1/2" high concrete bases unless specified otherwise. Mechanical contractor shall form all pads; General contractor shall provide and place all concrete and reinforcing for said pads. Individual concrete pad shall be no less than 4" wider and 4" longer than equipment, and shall extend no less than 2" from each side of equipment.

Provide each piece of equipment or apparatus suspended from ceiling or mounted above floor level with suitable structural support, platform or carrier in accordance with best-recognized practice. Verify that structural members of buildings are adequate to support equipment and



unless otherwise indicated on plans or specified, arrange for their inclusion and attachment to building structure. Provide hangers with vibration isolators.

Submit details of hangers, platforms and supports together with total weights of mounted equipment to Architect-Engineer for review before proceeding with fabrication or installation.

### 3.5. START-UP, CHANGEOVER, TRAINING AND OPERATIONAL CHECK

Contractor shall perform the initial start-up of the systems and equipment and shall provide necessary supervision and labor to make the first seasonal changeover of systems. Personnel qualified to start-up and service this equipment, including manufacturer's technicians, and the Owner's operating personnel shall be present during these operations.

Contractor shall be responsible for training Owner's operating personnel to operate and maintain the systems and equipment installed. Keep a record of training provided to Owner's personnel listing the date, subject covered, instructors name, names of Owner's personnel attending and total hours of instruction given each individual.

All owner-training sessions shall be orderly and well organized and shall be videotaped using digital format. At the end of the owner training, the "training tape" shall become property of the owner.

### 3.6. FINAL CONSTRUCTION REVIEW

At final construction review, each respective Contractor and major subcontractors shall be present or shall be represented by a person of authority. Each Contractor shall demonstrate, as directed by the Architect-Engineer, that the work complies with the purpose and intent of the contract documents. Respective Contractor shall provide labor, services, instruments or tools necessary for such demonstrations and tests.

### 3.7. MINIMUM CONSTRUCTION STANDARDS

Drawings and specifications indicate minimum construction standard. Should any work indicated be sub-standard to any ordinances, laws, codes, rules or regulations bearing on work, Contractor shall promptly notify Architect-Engineer in writing before proceeding with work so that necessary changes can be made. However, if the Contractor proceeds with work knowing it to be contrary to any ordinances, laws, rules, and regulations, Contractor shall thereby have assumed full responsibility for and shall bear all costs required to correct non-complying work.

### 3.8. PERMITS, INSPECTIONS, AND UTILITY FEES

The Contractor shall secure and pay for necessary permits and certificates of inspection required by governmental ordinances, laws, rules or regulations. Keep a written record of all permits and inspection certificates and submit two copies to Architect-Engineer with request for final inspection.

The Contractor shall include in their base bid any fees or charges by the local utility providers to establish new services to the structure. Coordinate with the utility suppliers to verify exactly which part of the work required for the new utility service, is to be performed by the contractor and which part will be supplied by the utility company.

END OF SECTION 230100

**SECTION 230500 - BASIC HVAC MATERIALS AND METHODS****1. PART 1 - GENERAL****1.1. RELATED DOCUMENTS**

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

**2. PART 2 – PRODUCTS**

Not Used

**3. PART 3 - EXECUTION****3.1. TESTING PROCEDURES FOR PIPING SYSTEMS**

Test all lines and systems before they are insulated, painted or concealed by construction or backfilling. Provide fuel, water, electricity, materials, labor and equipment required for tests.

Where entire system cannot be tested before concealment, test system in sections. Verify that system components are rated for maximum test pressures to be applied. Where specified test pressures exceed component ratings, remove or isolate components from system during tests. Upon completion, each system shall be tested as an entire system.

Repair or replace defects, leaks and material failures revealed by tests and then retest until satisfactory. Make repairs with new materials.

**3.2. Pressure Relief and Safety Valve:**

Before installation, test pressure temperature, and safety relief valves to confirm relief settings comply with specifications.

Tag items that pass test with date of test, observed relief pressure setting and inspector's signature.

Items installed in systems without test tag attached will be rejected.

All systems shall hold scheduled test pressures for specified time without loss of initial test pressure.

Upon completion of testing submit five copies of a typewritten report to A/E. Report shall list systems tested, test methods, test pressures, holding time and all failures with corrective action taken.

For test pressure schedules see Section 15100 of this specification.

**3.3. TESTING OF REFRIGERANT LINES**

After the system is installed and before any piping is insulated, the entire refrigeration circuit must be thoroughly leak tested. Test all pipe joints for leaks. Make certain that all joints are inspected thoroughly. Mark carefully any spots where leaks occur.

Leaks are repaired by disassembling the connection, cleaning the fitting and remaking. No attempt should be made to repair a leak by simply adding brazing material.

**3.4. CLEANING OF SYSTEMS AND EQUIPMENT**

After pressure testing of systems and equipment and before operational test thoroughly clean interiors of piping and equipment. Clean equipment as recommended by equipment manufacturers. Where specific instructions are not provided clean equipment systems as follows:

Air Handling Systems: Before starting any air system clean all debris, foreign matter and construction dirt from air system and fan. Provide equipment requiring filters, such as air handling units, fan coil units, blower, etc., with throw-away filters. After cleaning air system install temporary filters and run continuously for a minimum of eight hours at full volume before installing permanent filters. Provide temporary throw-away filters in all permanent heating and air conditioning equipment systems being utilized during construction. Prior to testing and balancing systems remove temporary filter media and install clean unused filters of the type specified. Clean filters shall be installed in equipment by mechanical contractor before final acceptance inspection by Architect and Engineer.

### 3.5. MAINTENANCE OF SYSTEMS

Contractor shall be responsible for operation, maintenance and lubrication of equipment installed under this contract.

Keep a complete record of equipment maintenance and lubrication and submit two copies with request for final construction review.

Records shall indicate types of lubricants used and date or time when next maintenance or lubrication will need to be performed by Owner. Where special lubricants are required, Contractor shall provide Owner with a one year supply as determine by Equipment Manufacturer's recommendations.

### 3.6. PAINTING OF MATERIALS AND EQUIPMENT

Touch-up painting and refinishing of factory applied finishes shall be by Mechanical Contractor. Contractor shall be responsible for obtaining proper type of painting materials and color from equipment manufacturer.

Unless specified otherwise factory built equipment shall be factory painted. Paint shall be applied over surfaces only after they have been properly cleaned and coated with a corrosion resistant primer.

After installation, damage to painted surfaces shall be properly prepared and primed with primers equal to factory materials. Finish coating shall be same color and type as factory finish.

Where extensive refinishing is required equipment shall be completely repainted.

END OF SECTION 230500

**SECTION 236000 - HVAC AIR SIDE EQUIPMENT****1. PART 1 - GENERAL****1.1. RELATED DOCUMENTS**

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

**2. PART 2 – PRODUCTS****2.1. MODULAR AIR HANDLING UNITS**

Furnish and install where shown on plans air-handling unit upgrades to the existing McQuay/Daikin units as hereinafter specified, and indicated in the schedule on the plans. All air handling units shall be by one manufacturer.

Equivalents by Daikin.

All units shall be tested, rated and certified as complete units in accordance with ARI Standard 430-66 and shall bear the ARI seal. Units shall be factory built and factory tested.

**2.1.1. CASING**

All units shall be of quality construction, braced, and reinforced for service intended. Removable panels (minimum 18 gauge) shall provide access to all internal parts. A double drain pan with glass fiber insulation between pans shall be furnished to meet requirements of NFPA-90A. Horizontal units shall have the drain pan extended under both fan and coil sections. Drain pans shall have a drain connection on both sides of unit. All unit panels shall be insulated with 1" thick 1-1/2 lb. density neoprene coated insulation. Provide two fan section hinged and latched access doors. Access doors shall be double wall with heavy duty ventlock style handle.

**2.1.2. FANS**

Centrifugal fans shall be of forward curved type with each fan wheel dynamically balanced and tested while installed in unit casing. Fans shall not pass through their first critical speed at any cataloged RPM. Bearings shall have a 200,000 hour average life and shall be greased lubricated with grease fittings extended to the drive side of the unit casing.

**2.1.3. MOTORS**

Motors shall be mounted on an adjustable mount furnished by manufacturer. All drives shall be adjustable V-belt type suitable for adjustment to within plus or minus 10% of required RPM and selected at 1.4 x MHP. BHP for each unit shall include belt and drive losses. Unit manufacturer shall provide an enclosed belt guard with hole located to take RPM readings unless motors are internally mounted. Where required, motors shall be capable of operating in conjunction with a variable speed controller. Unit manufacturer shall balance fan at 100 RPM increments up to fan maximum design RPM. Motors, shall be TEFC, with full size double wall access door with heavy duty ventlock style handles and view window where internally mounted for inspection. Provide one additional sheave per unit. First sheave shall be of the adjustable type for balancing, and shall be replaced with a fixed sheave at the completion of the system balance.

**2.1.4. COILS**

Cooling and heating coils shall be of the same manufacturer as the air handling unit. ARI Standard 410 shall certify capacities.

Aluminum plate fins with collars drawn, belled, and firmly bonded to copper tubes by mechanical expansion of tubes. No soldering or tinning shall be used in the bonding process. Coils shall have galvanized steel casing and shall be mounted pitched in the casing. Coils shall be removable through the unit panel. Coils shall be proof tested at 300 psig air pressure under water.

### 2.1.5. VIBRATION ISOLATION

Each air handling unit shall be mounted on spring type vibration isolators meeting specification Section "Mechanical Sound and Vibration Control"

## 2.2. CONDENSING UNITS

Provide complete systems as scheduled on plans by one manufacturer.

Equivalents by Trane, Carrier, McQuay, York.

### 2.2.1. CONDENSING UNITS

Units shall be assembled on heavy gauge steel mounting/lifting rails and shall be weather proof. Units shall include a hermetic reciprocating compressor(s), plate fin condenser coil, fans and motors, controls and holding charge. Operating range shall be between 115 degrees F and 35 degrees F in cooling as standard from the factory. Units shall be UL 1995 listed, CAS CAN/CAS-C22.2 No. 236-M90, certified and rated in accordance with ARI Standard 210/240, 360 and 270.

#### 2.2.1.1. CASING

Unit casing shall be constructed of 18 gauge zinc coated heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized and finished with a weather-resistant baked enamel finish.

Units' surface shall be tested 500 hours in salt spray test. Units shall have removable end panels which allow access to all major components and controls.

#### 2.2.1.2. REFRIGERATION SYSTEM - SINGLE COMPRESSOR

Units shall have a single refrigeration circuit. Each refrigeration circuit has an integral subcooling circuit. A refrigeration filter drier shall be provided as standard. The units shall have both a liquid line and suction gas line service valve with gauge port.

Units shall have one direct drive hermetic reciprocating compressor with centrifugal oil pump providing positive lubrication to moving parts. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage. Crankcase heater, temperature and current-sensitive motor overloads shall be included for maximum protection. Shall have integral spring isolation and sound muffling to minimize vibration transmission and noise. External high and low pressure cutout devices shall be provided. Evaporator defrost control provided in indoor blower coil shall prevent compressor slugging by temporarily interrupting compressor operation when low evaporator coil temperatures are encountered.

#### 2.2.1.3. REFRIGERATION SYSTEM - DUAL COMPRESSOR

Units shall have two separate and independent refrigeration circuits. Each refrigeration circuit shall have an integral subcooling circuit. A refrigeration filter drier shall be provided as standard. Units shall have both a liquid line and suction gas line service valve with gauge port.

Units shall have two direct drive hermetic reciprocating compressors with centrifugal oil pump and provide positive lubrication to all moving parts. Motor shall be suction gas cooled and shall have a voltage utilization range of plus or minus 10 percent of nameplate voltage. Crankcase heater, internal temperature and current-sensitive motor overloads shall be included for maximum protection. Shall have internal spring isolation and sound muffling to minimize vibration transmission and noise. External high and low pressure cutout devices shall be provided. Evaporator defrost control provided in indoor blower coil shall prevent compressor slugging by temporarily interrupting compressor operation when low evaporator coil temperatures are encountered.

#### 2.2.1.4. CONDENSER COIL

Coils shall be internally finned or smooth bore 3/8" copper tubes mechanically bonded to configured aluminum plate fin as standard. Factory pressure and leak tested to 425 psig air pressure. Metal grilles with PVC coating for coil protection is optional.

#### 2.2.1.5. CONDENSER FAN AND MOTOR(S)

Direct-drive, statically and dynamically balanced propeller fan(s) with aluminum blades and electro-coated steel hubs shall be used in draw-through vertical discharge position. Either permanently lubricated totally enclosed or open construction motors shall be provided and shall have built in current and thermal overload protection. Motor(s) shall have to be either ball or sleeve bearing type.

#### 2.2.1.6. CONTROLS

Condensing units shall be completely factory wired with necessary controls and contactor pressure lugs or terminal block for power wiring. Control wiring shall be 24-volt control circuit which includes fusing and control transformer. Units shall provide external location for mounting a fused disconnect device.

#### 2.2.1.7. ACCESSORIES

##### 2.2.1.7.1. Time Delay Relay

Shall prevent compressors in dual compressor unit from coming on line simultaneously. Timer shall be 24-volt, 60 cycle, with four minute timing period.

##### 2.2.1.7.2. Anti-Short-Cycle Timer

Shall prevent rapid on-off conditions by not allowing compressor to operate for 5-7 minutes upon shutdown. Shall consist of a solid state timing device, 24 volt, 60 cycle with either 5 or 7 minute fixed-off timing period.

Louvered hail guard for the condenser shall be provided to alleviate coil damage.

##### 2.2.1.7.3. Evaporator Coils

Shall be completely factory assembled including the expansion valves and drain pans. Single circuit condensing units shall be matched to single circuit coils and dual circuit condensing units to dual circuit coils. Unit casing shall be constructed of zinc coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized and finished with an enamel finish. Casing shall be completely insulated with fire-retardant, permanent, odorless glass fiber material. The coils shall be convertible to either vertical and/or horizontal airflow configuration. Aluminum fin surface shall be mechanically bonded to 3/8" OD copper tubing. Coils shall be factory pressure and leak tested.

##### 2.2.1.7.4. Vibration Isolators

Shall reduce transmission of noise and vibration to building structures, equipment and adjacent spaces. Packages shall be available in either neoprene-in shear or spring-flex types in floor or suspended mountings.

Provide 7-day electronic programmable thermostat for 1 or 2-stage heating and 1 or 2-stage cooling as scheduled on the plans.

### **3. PART 3 - EXECUTION**

All HVAC air side equipment shall be cleaned and free of all construction debris. Install units as shown and detailed on the plans and per manufacturers directions.

See plans for equipment schedules.

END OF SECTION 236000

**SECTION 239575 - AUTOMATIC TEMPERATURE CONTROLS - DDC****1. PART 1 - GENERAL****1.1. RELATED DOCUMENTS**

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

**1.2. SUMMARY**

This Section includes control equipment for building energy consuming systems such as HVAC systems plus control components for terminal heating and cooling units that are not supplied with factory-wired controls.

**1.3. SYSTEM DESCRIPTION**

There is a separate HVAC Controls upgrade project, these new units shall be connected to those controls.

**1.4. STARTUP, TESTING AND ADJUSTMENTS**

Manufacturer's Field Services: Provide the services of a factory-authorized service representative to start control systems.

Test and adjust controls and safeties.

Replace damaged or malfunctioning controls and equipment.

Setup, start, test, adjust and verify accuracy control systems. Make ready for Test and Balance Agency work.

Demonstrate compliance with requirements.

Verify all thermostats and VAV box controls are functioning properly.

Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

Coordinate with and support as requested test and balance activities being performed by others.

**1.5. DEMONSTRATION**

A. Manufacturer's Field Services: Provide the services of a factory-authorized service representative to demonstrate and train Owner's maintenance personnel as specified above.

**1.6. TESTING AND BALANCING COORDINATION**

The temperature control contractor shall have a technical representative present with the balancing contractor on the first day of balancing for a minimum of four hours of active balancing and temperature controls coordination.

For the remainder of the balancing the temperature contractor may either have a technical representative present, or may furnish the balancer with the latest DDC software and all required interface devices. This includes instructions and coordination in the use of all interface devices, including laptop computers. There shall be no charge to the balancing contractor for the use of these interface devices and they shall be returned to the temperature controls contractor at the end of the balancing process.

END OF SECTION 239575

**SECTION 239900 - SYSTEM TESTING & BALANCING****1. PART 1 - GENERAL****1.1. RELATED DOCUMENTS**

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

**1.2. TESTING AND BALANCING CONTRACTORS**

Testing and balancing (TAB) of the building air and hydronic systems will be to be completed near the end of construction. The Mechanical Contractor has responsibility to cooperate with, make adjustments for, and provide any equipment necessary for the TAB contractor to complete the job.

Acceptable Testing and Balancing Contractors:

Energy Management and Control Corporation, Topeka, Kansas

Allied Labs, Wichita, Kansas

Environmental Systems Testing, Lenexa, Kansas

Doyle Field Services, KC, Missouri

Pro Balance, Blue Springs, Missouri

**2. PART 2 – PRODUCTS**

Not Used

**3. PART 3 - EXECUTION****3.1. SYSTEM PREPARATION FOR TESTING AND BALANCING**

Prior to requesting testing and balancing contractor to perform their work the installing contractor shall make all necessary inspections and adjustments to insure that systems are completely installed and operating in accordance with the manufacturer's recommendations and the contract documents.

The following checks shall be performed on each system installed under this contract. A report sheet shall be prepared for each system indicating checks made, corrective action taken where required, date, and name of person making inspection. Submit one copy to testing and balancing contractor and two to A/E. Testing and balancing contractor will not begin until checklist has been received and reviewed.

**3.2. TEMPERATURE CONTROLS CONTRACTOR COORDINATION**

The temperature control contractor shall have a technical representative present with the balancing contractor on the first day of balancing for a minimum of four hours of active balancing and temperature controls coordination.

For the remainder of the balancing the temperature contractor may either have a technical representative present, or may furnish the balancer with the latest DDC software and all required interface devices. This includes instructions and coordination in the use of all interface devices, including laptop computers. There shall be no charge to the balancing contractor for the use of these interface devices and they shall be returned to the temperature controls contractor at the end of the balancing process.

**3.3. AIR HANDLING SYSTEMS:**

Clear system of all foreign objects and clean system.

Verify fan rotation.



Check bearing condition and lubrication.

Check fan wheel clearances and fan alignment.

Check motor security to mounting base.

Check alignment of drive.

Check vibration isolator adjustment.

Verify that proper filter media is installed.

Verify that all control dampers are installed and operable without binding or sticking.

Confirm that all fire, smoke and volume dampers are installed and in full open position.

Verify that all air terminal units are installed.

Confirm that all air openings in walls above ceilings have been provided.

Check for and repair all excessive air leaks in duct systems, at equipment connections and at coils.

Air leaks shall not exceed SMACNA parameters for system pressure.

Verify that ductwork is constructed and installed in accordance with contract drawings and/or approved ductwork shop drawings.

Inspect and clean all coils(including evaporator and condenser) and correct fin damage.

### 3.4. AIR BALANCE

The Contractor shall procure the services of an independent air balance and testing contractor, approved by the A/E, which specializes in the balancing and testing of heating, ventilating and air conditioning systems, to balance, adjust, and test air moving equipment and air distribution and exhaust systems and all water flow circuits. All work by this contractor shall be done under engineer employed by them. All instruments used by this contractor shall be accurately calibrated and maintained in good working order. If requested the tests shall be conducted in the presence of the A/E responsible for the project and/or his representative. The testing and balancing contractor shall be certified by NEBB or AABC and all work shall be performed in accordance with these organizations' published procedure manuals.

The balancing contractor shall prepare a certified report of all tests performed. The report shall be written on standard forms prepared by NEBB or AABC or facsimiles thereof. The balancing contractor shall submit 3 copies of this report to the Mechanical Contractor who shall submit them to the A/E for review and distribution.

Air balance and testing shall not begin until systems have been completed and are in full working order. All heating, ventilation, and air conditioning systems and equipment shall be in full operation during each working day of testing and balancing.

The Balancing reports shall include the line drawing of each ductwork system as installed, a line drawing of the heating and cooling water piping as installed; an elevation of each air handling unit as installed showing outdoor air return air an supply air ductwork connections, coil arrangements and damper arrangements, a psychometric chart on each air handling unit, with a cooling coil, showing outdoor temperature, return air temperature, mixed air temperature at a minimum outdoor air condition, coil leaving air condition at full cooling coil water flow. The balancing report shall also include all NEBB or AABC forms completed as required by each respective certification.

The TAB contractor shall cycle each air handling unit through its control sequence of operation to verify proper operation. Any inconsistency with contract documents shall be reported to A/E and temperature control contractor. Temperature control contractor shall take prompt action to correct any control inconsistency as reported by the TAB contractor.

During installation of the mechanical systems the testing and balancing contractor shall make no less than (3) inspection visits to the project site. Proper placement and installation of all control

and balancing devices shall be verified by these inspections. The mechanical contractor shall make all corrections in control and balancing device locations as requested by the TAB contractor. Following each inspection visit the TAB contractor shall report to the A/E all items noted, action taken, and progress of control device installation. The last inspection and balancing shall be performed in the presence of a professional engineer active in the design of mechanical building systems.

END OF SECTION 239900