

## SECTION 230500 - GENERAL PROVISIONS

### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

#### 1.2 CONTRACT DOCUMENTS

- A. All contract documents including drawings, alternates, addenda and modifications preceding this specification division are applicable to Mechanical Contractor and his Sub-Contractors, and material suppliers.

#### 1.3 SPECIFICATION FORM AND DEFINITIONS

- A. These Specifications are abbreviated form and contain incomplete sentences. Omissions of words or phrases such as "the contractor shall", "shall be", "as noted on the Drawings", "according to the drawings", "a", "an", "the" and "all" are intentional. Omitted words and phrases shall be supplied by inference.
- B. The term "Engineer" wherever used in these specifications, shall mean LATIMER, SOMMERS & ASSOCIATES, P.A., 3639 SW SUMMERFIELD DRIVE, SUITE A, TOPEKA, KANSAS 66614, PHONE 785-233-3232, FAX 785-233-0647.
- C. Contractor, wherever used in these specifications, shall mean any trade contractor that enters into contract with the Owner to perform this section of work.
- D. When a word, such as "proper", "satisfactory", "equivalent", and "as directed", is used, it requires Engineer's review. The equivalency of the proposed product or manufacturer to be used in lieu of the specified product or manufacturer is the sole decision of the Engineer.
- E. "Provide" means furnish and install.
- F. The term "Engineer" hereinafter abbreviated A/E, or words "Architect-Engineer", or words "Architect/Engineer" shall mean Design Engineers, Latimer, Sommers & Associates, P.A.

#### 1.4 QUALIFICATIONS

- A. The contractor(s) responsible for work under this section shall have completed a job of similar scope and magnitude within the last 3 years and be able to document such work upon request. The contractor(s) shall employ an experienced, competent and adequate work force licensed in their specific trade and properly supervised at all times. Commercial Mechanical Contracting shall be the company's primary nature of business with a minimum of 5 years commercial experience. 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 contractor(s) shall comply with all applicable local, state and federal guidelines, practices and regulations. Contractor may be required to submit a statement of qualifications, pertaining to the type of work to be performed, upon request before any final approval and selection. If contractor has prior contracting relationship(s) with the owner, they shall be in good-standing with respect to their prior obligations and be able to provide references to attest to the nature of their work and quality. Failure to be able to comply with these requirements is suitable reason for rejection of a bid whether acting as a prime or subcontractor.

## 1.5 SUPERVISION

- A. The contractor shall employ an experienced, competent and adequate work force licensed in their specific trade and properly supervised at all times.
- B. 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.
- C. A "Foreman" shall be present during all work activity required to complete the project. The "Foreman" shall be an individual who has received appropriate training from a recognized training organization and who has adequate experience in the supervision of similar workforce and be a "Journeyman" or "Master". The qualification statement of the "Foreman" shall be submitted and approved by the Engineer prior to the start of work.
- D. "Master" and "Journeyman" shall be individuals who have received appropriate training, and experience and who have taken and passed the appropriate tests as administered by a recognized testing agency. The qualifications of all "Master" and "Journeyman" tradesmen shall be submitted and approved by the Engineer prior to the start of work.
- E. "Apprentice" shall be an individual who is currently in a recognized training program in the particular trade the express purpose of which is to result in the individual becoming licensed as a "Journeyman" in that trade. This individual shall be supervised at all times installation work is being completed.
- F. "Laborer" or "Helper" shall be an individual who provides support of each the "Master," "Journeyman" and "Apprentice." This individual shall not perform any unsupervised installation.
- G. The makeup of the workforce shall be in the following ratio:
  - 1. Master -1 (not necessarily present on site daily but an employee of the company bidding the project and involved with all aspects of the project throughout construction)
  - 2. Journeyman – 2 or more
  - 3. Apprentice -1
  - 4. Helper -1

Note that a "Master" can serve as a "Journeyman."

## 1.6 LOCAL CONDITIONS

- A. Visit site and determine existing local conditions affecting work in contract. Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

## 1.7 CONTRACT CHANGES

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

## 1.8 LOCATIONS AND INTERFERENCES

- A. Locations of equipment, piping and other mechanical work is indicate diagrammatically by mechanical drawings. Determine exact locations on job, subject to structural conditions, work of

other Contractors, access requirements for installation and maintenance to approval of Architect-Engineer.

- B. 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 workmen 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.
- C. Any pipe, apparatus, appliance or other item interfering with proper placement of other work as indicated on drawings, specified, or required, shall be removed and if so shown, 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.
- D. Do not scale mechanical and electrical drawings for dimensions. Accurately lay-out work from dimensions indicated on drawings unless such is found in error.
- E. Report any conflict stated above to supervisor for coordination.

#### 1.9 PERFORMANCE

- A. 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.

#### 1.10 WARRANTY

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

#### 1.11 ALTERNATES

- A. Refer to General Requirements for descriptions of any alternates which may be included.

#### 1.12 MATERIALS, EQUIPMENT AND SUBSTITUTIONS

- A. 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.
- B. Material and equipment installed under this contract shall be first class quality, new, unused and without damage.
- C. In general, these specifications identify required materials and equipment by naming first the manufacturer whose product was used as the basis for the project design and specifications. The manufacturer's product, series, model, catalog and/or identification numbers shall set quality and

capacity requirements for comparing the equivalency of other manufacturer's products. Where other manufacturer's names are listed they are considered an approved manufacturer for the product specified, however; the listing of their names implies no prior approval of any product they may propose to furnish as equivalent to the first named product unless specific model or catalog numbers are listed in these specifications or in subsequent addenda. Where other than first named products are used for base bid proposal it shall be the responsibility of the Contractor to determine prior to bid time that the proposed materials and equipment selections are products of approved manufacturers which meet or exceed the specifications and are acceptable to the Engineer.

- D. 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.
- E. 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.

In proposing a substitution prior to receipt of bids, include in such proposal cost of altering other elements of project, including adjustments in mechanical/electrical service requirements necessary to accommodate such substitution.

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.

- F. In proposing a substitution prior to or subsequent to receipt of bids, include in such bid cost of altering other elements of project, including adjustments in mechanical/electrical service requirements necessary to accommodate such substitution. In addition, all physical space and weight requirements requiring additional structural support, modifications to the base floor plans, equipment concrete pad/roof curb dimensions shall be incorporated as required into such bid to accommodate such substitutions.
- G. Within 10 working days after bids are received, apparent low bidder shall submit to Architect-Engineer for approval three copies of a list of all major items of equipment he intends to provide. As soon as practicable and within 10 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 10 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 10 working day limit.

#### 1.12 SHOP DRAWINGS, OPERATION AND MAINTENANCE INSTRUCTIONS

- A. Refer to Division 1 for additional requirements.
- B. Contractor shall furnish shop drawings of all materials and equipment. These shop drawings shall be submitted to the Engineer in electronic "PDF" format. A copy of fully processed product data submittal shall be included as a part of each operating and maintenance manual.

- C. Where catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, fitting sizes, etc., that are to be provided. Mark submitted item with applicable section and paragraph numbers of these specifications, or Drawing sheet number when item does not appear in specifications. Where equipment submitted does not appear in specifications or specified equivalent, mark submittals with applicable alternate numbers, change order number or letters of authorization. Each catalog sheet shall bear Equipment Manufacturer's name and address. All shop drawings on materials and equipment listed by UL shall indicate UL approval on submittal.
- D. Contractor shall be required to submit all applicable equipment/material assembly mock-ups as required by the Contract Documents for Engineer approval. Contractor shall provide changes and resubmit mock-ups until Engineer is satisfied final product meets or exceeds stated specifications and quality of specified product.
- E. Contractor shall check all shop drawings to verify that they meet specifications and/or drawings requirements before forwarding submittals to the Engineer for their review.
- F. All shop drawings submitted to Engineer shall bear Contractor's approval stamp which shall indicate that Contractor has reviewed submittals and that they meet specification and drawing requirements. Contractor's submittal review shall specifically check for but not be limited to the following: equipment capacities, physical size in relation to space allowed, electrical characteristics, provisions for supply, return and drainage connections to building systems. All shop drawings not meeting Contractor's approval shall be returned to its supplier for resubmittal.
- G. No shop drawing submittals will be considered for review by the Engineer without Contractor's approval stamp, or that have extensive changes made on the original submittal as a result of Contractor's review. All comments or minor notations on shop drawings shall be flagged to indicate originator of comment.
- H. Engineer's review of shop drawings will not relieve Contractor of responsibility for deviations from drawings and specifications unless such deviations have been specifically approved in writing by Owner or its representative, nor shall it relieve Contractor of responsibility for errors in shop drawings. No work shall be fabricated until Engineer's review has been obtained with "no exceptions" or "as noted" language. Any time delay caused by correcting and resubmitting shop drawings will be Contractor's responsibility.
- I. In general, the contractor shall submit the following items for this project (not all may be listed):
  - a. Kitchen Hood
  - b. Ductwork
  - c. Duct Sealant
  - d. Steel
  - e. General Construction Materials
  - f. Duct Insulation
  - g. Hangers
  - h. Make-up Air Units
  - i. Exhaust Fans
  - j. Hood Controls

### 1.13 OPERATION AND MAINTENANCE INSTRUCTIONS

- A. Refer to Division 1 for requirements.

### 1.13 CAD FILES

- A. CAD files will not be available.

#### 1.14 CUTTING AND PATCHING

- A. Contractor shall do cutting and patching of building materials required for installation of work herein specified. Cut no structural members without Engineer's approval and in a manner approved by him.
- B. Patching shall be by mechanics of particular trade involved and shall meet approval of Engineer.
- C. Drilling and cutting of openings through building materials requires Engineer's review and approval. 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.

#### 1.15 MUTILATION

- A. Mutilation of building finishes, caused by installation of mechanical work shall be repaired at Mechanical Contractor's expense to approval of Engineer.

#### 1.16 SETTING, ADJUSTMENT AND EQUIPMENT SUPPORTS

- A. 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 manufacturers instructions. Equipment failures resulting from improper installation or field alignment shall be repaired or replaced by Contractor at no cost to Owner.
- B. Provide floor or slab mounted equipment with 3-1/2" high concrete bases unless specified otherwise. General contractor shall form all pads and/or structures. General contractor shall provide and place all concrete and reinforcing for said pads and/or structures. 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.
- C. 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 where required.
- D. 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.

#### 1.17 START-UP, CHANGEOVER, TRAINING AND OPERATIONAL CHECK

- A. Contractor shall perform initial start-up of systems and equipment and shall provide necessary supervision and labor to make first seasonal changeover of systems. Personnel qualified to start-up and service this equipment, including manufacturers technicians when specified, and Owner's operating personnel shall be present during these operations.
- B. Factory start-up and associated reports completed by factory representative(s) shall be submitted for all major mechanical equipment including but not limited to boilers, chillers, water heaters, air handlers, etc. Reference specifications where applicable.
- C. Contractor shall be responsible for training Owner's operating personnel to operate and maintain 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.

- D. All owner-training sessions shall be orderly and well organized and shall be professionally videotaped. At the end of the owner training, a USB flash drive with all videotaped owner-training sessions shall become property of the owner.

#### 1.18 FINAL CONSTRUCTION REVIEW

- A. 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 Architect/Engineer, that work complies with purpose and intent of plans and specifications. Respective Contractor shall provide labor, services, instruments or tools necessary for such demonstrations and tests.

#### 1.19 OPENINGS, ACCESS PANELS AND SLEEVES

- A. 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 as shown on structural plans that pass through beams. All floor penetrations shall be sealed to meet fire-rating requirements.

END OF SECTION 230500

## SECTION 230501 - EXTENT OF CONTRACT WORK AND CODES

### PART 1 - GENERAL (Reference Section 230500)

#### 1.1 GENERAL

- A. 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.
- B. Contractor shall become familiar with equipment provided by other contractors which require mechanical connections and controls.
- C. 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 temperature control wiring shall be by temperature control contractor.
- D. All automatic temperature control devices shall be mounted as indicated in automatic temperature control section of specifications.
- E. 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.
- F. 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.
- G. 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.
- H. Contractor shall obtain complete electrical data on mechanical shop drawings and shall list this data on an approved form which 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.
- I. Discrepancies within the plans or between specifications and plans shall be brought to the attention of the Engineer prior to bid, otherwords pricing shall be based on higher quantity, quality and/or higher cost indication.

#### 1.2 WORK NOT INCLUDED IN CONTRACT

- A. Consult Division 26 of specifications for work to be provided by Electrical Contractor in conjunction with installation of mechanical equipment.
- B. Safety disconnect switches and manual and magnetic motor starters shall be provided by Electrical Contractor. Exceptions will be allowed where mechanical equipment is provided with these devices installed as part of factory built control systems.

### 1.3 CODES, RULES AND REGULATIONS

- A. Provide Work in accordance with applicable codes, rules and regulations of Local and State, Federal Governments and other authorities having lawful jurisdiction.
- B. Conform to latest editions and supplements of following codes, standards or recommended practices.

#### INTERNATIONAL CODES:

International Building Code – 2018  
International Building Fire Code – 2018  
International Mechanical Code – 2018  
International Plumbing Code – 2018

#### SAFETY CODES:

National Electrical Safety Code Handbook H30 - National Bureau of Standards.  
Occupational Safety and Health Standard (OSHA) - Department of Labor.

#### NATIONAL FIRE CODES:

NFPA No. 70 National Electrical Code - 2017  
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 - 2018  
NFPA No. 204 Smoke & Heating Vent Guide

#### UNDERWRITERS LABORATORIES INC:

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

#### MISCELLANEOUS CODES:

ANSI A117.1 - Handicapped Accessibility  
Kansas Maximum Lighting Standards  
Kansas Thermal Standards  
ASHRAE 90-1-2013  
Kansas State Boiler Code  
Americans with Disabilities Act (ADA) - 2010

- C. 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 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.
- D. 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.

Larned State Hospital  
Replace Suppression System Hood in Kitchen  
Jung Building  
Larned, Kansas

OFPM Project No. A-014116  
December 2020

- E. Contractor shall include in bid any charges by local utility providers to establish new services to the structure. Coordinate with the utility suppliers to verify exact which part of the work is to be performed by whom.

END OF SECTION 230501

## SECTION 230503 - BASIC MATERIALS AND METHODS

### PART 1 – GENERAL (Reference Section 230500)

#### 1.1 TESTING PROCEDURES FOR PIPING SYSTEMS

- A. 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.
- B. Where entire system cannot be tested before concealment, test system in sections. Upon completion, each system shall be tested as an entire system.
- C. Repair or replace defects, leaks and material failures revealed by tests and then retest until satisfactory. Make repairs with new materials.
- D. 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.

#### 1.2 TEST METHODS AND PRESSURES

- A. Test methods and pressures shall be as follows:
  - 1. Hydrostatic Test (Closed Systems):
    - a. Hydrostatic test shall be performed using clean unused domestic water. Test pressures shall be as scheduled for system or 150% of operating pressure where not specified.
  - 2. Hydrostatic Test (Open System):
    - a. Test entire system with 10 foot head of water. Where system is tested in sections each joint in building except uppermost 10 feet of system shall be submitted to at least 10 foot head of water. Water shall be held in system for 15 minutes before inspection starts. System shall hold test pressure without leaks.
  - 3. Pneumatic Test:
    - a. Test entire system with compressed air. Systems operating above 25 PSI shall be tested at 75 PSI or 15% of operating pressure or whichever is greater.  
  
Allow at least 1 hour after test pressure has been applied before making initial test.
    - b. Curing test, completely isolate entire system from compressor or other sources of air pressure.
  - 4. Pressure Relief and Safety Valve:
    - a. Before installation, test pressure temperature, and safety relief valves to confirm relief settings comply with specifications.
    - b. Tag items that pass test with date of test, observed relief pressure setting and inspector's signature.

- c. Items installed in systems without test tag attached will be rejected.
- B. All systems shall hold scheduled test pressures for specified time without loss of initial test pressure.
- C. 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.
- D. For test pressure schedules see Sections 232113 of this specification.

### 1.3 LOW SIDE CHARGING

- A. Small amounts of refrigerant may be added to the system in the gaseous state through the backseat port of the compressor suction valve. When refrigerant is to be added in this manner, backseat the suction valve and purge the charging line before tightening the connection at the valve port.
- B. CAUTION: When low side charging, gaseous refrigerant is drawn from the top of the refrigerant container.
- C. Start the compressor, crack the suction valve clear of its backseat and open the valve on the refrigerant container. The compressor will then pump gaseous refrigerant from the container into the system.

### 1.4 STERILIZATION OF DOMESTIC WATER SYSTEMS

- A. Clean piping as follows:
  - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate potable water system according to either of the following:
      - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no elevated chlorine is in water coming from system after the standing time.

### 1.5 CLEANING OF SYSTEMS AND EQUIPMENT

- A. 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.

#### 1.6 MAINTENANCE OF SYSTEMS

- A. Contractor shall be responsible for operation, maintenance and lubrication of equipment installed under this contract.
- B. Keep a complete record of equipment maintenance and lubrication and submit two copies with request for final construction review.
- C. 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.

#### 1.7 PAINTING OF MATERIALS AND EQUIPMENT

- A. 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.
- B. 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.
- C. 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.
- D. Where extensive refinishing is required equipment shall be completely repainted.

#### 1.8 LABELING AND IDENTIFYING PIPING SYSTEMS

- A. Install pipe markers on each system. Include arrows showing normal direction of flow. Markers shall be sized for respective pipe/insulation sizes per ASME and ANSI.
- B. Marker Type: Vinyl tape markers (Seton or equal) complying with ASME A13.1, ANSI and OSHA.
- C. Fasten markers on pipes and insulated pipes smaller than 6 inches OD by one of the following methods:
  - 1. Snap-on application of pretensioned, semi-rigid plastic pipe marker.
  - 2. Adhesive lap joint in pipe marker overlap.
  - 3. Laminated or bonded application of pipe marker to pipe or insulation.
  - 4. Taped to pipe or insulation with color-coded plastic adhesive tape, not less than 3/4-inch wide, lapped a minimum of 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
- D. Fasten markers on pipes and insulated pipes 6 inches in diameter and larger by one of following methods:
  - 1. Laminated or bonded application of pipe marker to pipe or insulation.
  - 2. Taped to pipe or insulation with color-coded plastic adhesive tape, not less than 1-1/2 inches wide, lapped a minimum of 3 inches at both ends of pipe marker, and covering full circumference of pipe.
  - 3. Strapped to pipe or insulation with manufacturer's standard stainless-steel bands.

- E. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior non-concealed locations according to the following:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
  - 3. Near penetrations through walls, floors, ceilings, or non-accessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at a maximum of 20-foot intervals along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.
- F. Provide field painted pipe labels and arrows for piping systems with aluminum jackets. Labels shall be stenciled. Provide black lettering.

#### 1.9 EQUIPMENT SIGNS AND MARKERS

- A. Install engraved plastic-laminate signs or equipment markers on or near each major item of mechanical equipment. Include signs for the following general categories of equipment:
  - 1. Main control and operating valves, including safety devices and hazardous units such as gas outlets:
  - 2. Fire department hose valves and hose stations.
  - 3. Meters, gages, thermometers, and similar units.
  - 4. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
  - 5. Pumps, compressors, chillers, condensers, and similar motor-driven units.
  - 6. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
  - 7. Fans, blowers, primary balancing dampers, and mixing boxes.
  - 8. Packaged HVAC central-station, roof top units and zone-type units.
  - 9. Tanks and pressure vessels.
  - 10. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
- B. Optional Sign Types: Vinyl tape signs may be provided instead of engraved plastic, at Installer's option, where lettering larger than 1-inch high is needed for proper identification because of distance from normal location of required identification.
  - 1. Lettering Size: Minimum 1/4-inch for name of units if viewing distance is less than 24 inches, 1/2-inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - 2. Terms on Signs: Distinguish between multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
- C. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows showing service and direction of flow.
  - 1. Location: Locate signs near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

#### 1.10 VALVE IDENTIFICATION

- A. Mark all valves with Seton No. 300-BL brass identification tags with system legend, valve number and size stamped on tag. Lettering shall be black 1/2" high. Tags shall be minimum 2" in diameter and attached to valve with Seton No. 16 brass jack chain.
- B. Prepare four copies of typewritten list of valve tags. List shall be typed in upper case and contain tag number, valve size, type, function and location. Frame one list under glass and mount near operating instruction in main equipment rooms.

#### 1.11 EXCAVATION AND BACKFILL

- A. Perform necessary excavation to receive Work. Provide necessary sheathing, shoring, cribbing, tarpaulins, etc. for this operation, and remove same at completion of work. Perform excavation in accordance with appropriate section of these specifications, and in compliance with OSHA Safety Standards.
- B. Excavate trenches of sufficient width to allow ample working space, and no deeper than necessary for installation work.
- C. Conduct excavations so no walls or footings are disturbed or injured. Backfill excavations made under or adjacent to footing with selected earth or sand and tamp to compaction required by Architect-Engineer. Mechanically tamp backfill under concrete and paving in six-inch layers to 95% standard density, Reference Division 2.
- D. Backfill trenches and excavations to required heights with allowance made for settlement. Tamp fill material thoroughly and moistened as required for specified compaction density. Dispose of excess earth, rubble and debris as directed by Architect.
- E. When available, refer to test hole information on Architectural drawings or specifications for types of soil to be encountered in excavations.

#### 1.12 FIRESTOPPING PENETRATIONS IN FIRE-RELATED WALL/FLOOR ASSEMBLIES

- A. Contractors shall provide proper sizing when providing sleeves or core-drilled holes to accommodate their through penetrating items. All voids between sleeve or core-drilled hole and pipe passing through, shall be firestopped to meet the requirements of ASTM E-814.

END OF SECTION 230503

## SECTION 230513 - ELECTRICAL REQUIREMENTS

### PART 1 - GENERAL (Reference Section 230500)

### PART 2 - PRODUCTS

#### 2.1 ELECTRICAL REQUIREMENTS

- A. Consult Division 26 of specifications for work to be provided by E/C in conjunction with installation of mechanical equipment.
- B. Electrical work required to install and control mechanical equipment which is not shown on plans or specified under Division 26 shall be included in M/C's base bid proposal.
- C. 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 Section 230500 of specifications shall be paid for by M/C at no cost to Owner or A/E.
- D. M/C shall be responsible for providing supervision to E/C to insure that required connections, interlocking and interconnection of mechanical and electrical equipment are made to attain intended control sequences and system operation.
- E. Furnish six complete sets of electrical wiring diagrams to A/E and three complete sets to E/C. Diagrams shall show factory and field wiring of components and controls. Control devices and field wiring to be provided by E/C shall be clearly indicated by notation and drawing symbols on wiring diagrams.
- F. M/C shall obtain complete electrical data on mechanical shop drawings and shall list this data on an approved form which shall be presented on request to A/E. 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 E/C to order electrical equipment required in the contract.
- G. Safety disconnect switches and manual and magnetic motor starters shall be provided by E/C. Exceptions will be allowed where mechanical equipment is provided with these devices installed as part of factory-built control systems.

END OF SECTION 230513

## SECTION 230529 - SUPPORTS, ANCHORS, SLEEVES AND SEALS

### PART 1 – GENERAL (Reference Section 230500)

### PART 2 – PRODUCTS

#### 2.1 PIPE SLEEVES AND SEALS

- A. Furnish proper type and size pipe sleeves to General Contractor for installation in concrete or masonry walls or floors. Sleeves are not required for supply and waste piping through wall supporting plumbing fixtures or for cast iron soil pipe passing through concrete slab or grade except where penetrating a membrane waterproof floor. Mechanical Contractor shall supervise installation of sleeves to insure proper location and installation.
- B. Each sleeve shall be continuous through wall floor or roof and shall be cut flush on each side except where indicated otherwise. Sleeves shall not be installed in structural member except where indicated or approved.
- C. Sleeves passing through above grade floors subject to flooding such as toilet rooms, bathrooms, equipment rooms and kitchens shall be cast iron with integral flanges and shall extend 1 inch above finished floor. Size sleeves for and seal space between pipe sleeve with Thunderline Link-Seal.
- D. Provide steel pipe sleeves in bearing walls and masonry walls. Opening in non-bearing walls, floors and ceilings may be 20 gauge galvanized pipe sleeves or openings cut with concrete core drill.
- E. Pipe insulation shall run continuous through pipe sleeves with 1/4" minimum clearance between insulation and pipe sleeve. Provide metal jackets over insulated pipes passing through fire walls, floors and smoke partitions. Jacket shall be 0.018 stainless steel extending 12 inches on either side of barrier and secured to insulation with 3/8" wide band. Seal annular space between jacket and pipe sleeves with Thunderline High Temperature Link Seal.
- F. Pipe wall penetrations exposed to view shall have tight fitting escutcheons or flanges to cover all voids around openings.

#### 2.2 PIPE HANGERS AND SUPPORTS

- A. Provide and be responsible for locations of piping hangers, supports and inserts, etc., required for installation of piping under this contract. Design of hangers and supports shall conform to current issue of Manufacturers Standardization Society Specification (MSS) SP-58.
- B. Pipe hangers shall be capable of supporting piping in all conditions of operation. They shall allow free expansion and contraction of piping, and prevent excessive stress resulting from transferred weight being induced into pipe or connected equipment. Support horizontal or vertical pipes at locations of least vertical movement.
- C. Where horizontal piping movements are such that hanger rod angularity from vertical is greater than 4 degrees from cold to hot position of pipe, offset hanger, pipe, and structural attachments to that rod is vertical in hot position. Hangers shall not become disengaged by movements of supported pipe.

D. Provide sufficient hangers to adequately support piping system at specified spacing, at changes in piping direction and at concentrated loads. Hangers shall provide for vertical adjustment to maintain pitch required for proper drainage, and for longitudinal travel due to expansion and contraction of piping. Fasten hangers to building structural members wherever practicable.

E. Unless indicated otherwise on drawings support horizontal steel piping as follows:

| <u>PIPE SIZE</u> | <u>ROD DIAMETER</u> | <u>MAXIMUM SPACING</u> |
|------------------|---------------------|------------------------|
| Up to 1-1/4"     | 3/8"                | 8 Ft.                  |
| 1-1/2" to 2"     | 3/8"                | 10 Ft.                 |
| 2-1/2" to 3-1/2" | 1/2"                | 12 Ft.                 |
| 4" and 5"        | 5/8"                | 15 Ft.                 |

F. Unless indicated otherwise on drawings support horizontal copper tubing as follows:

| <u>NOM. TUBING SIZE</u> | <u>ROD DIAMETER</u> | <u>MAXIMUM SPACING</u> |
|-------------------------|---------------------|------------------------|
| Up to 1"                | 3/8"                | 6 Ft.                  |
| 1-1/4" to 1-1/2"        | 3/8"                | 8 Ft.                  |
| 2"                      | 3/8"                | 9 Ft.                  |
| 2-1/2"                  | 1/2"                | 9 Ft.                  |
| 3" and 4"               | 1/2"                | 10 Ft.                 |

G. Support horizontal cast iron soil pipe with two hangers for each section located close to each hub.

H. Support vertical cast iron soil pipe at every floor, steel and copper tubing at every other floor except where indicated otherwise on drawings.

I. Provide continuous threaded hanger rods wherever possible. No chain, wire, or perforated straps shall be used. Hanger rods shall be subject to tensile loading only, where lateral or axial pipe movement occurs provide suitable linkage to permit swing. Provide pipe support channels with galvanized finish for concealed locations and painted finish for exposed locations. Submit design for multiple pipe supports indicating pipe sizes, service and support detail to Architect/Engineer for review prior to fabrication.

J. Provide Grinnell pipe hangers for vertical pipe risers as follows:

| <u>PIPE MATERIAL</u> | <u>PIPE SIZE</u> | <u>HANGER FIG. NO.</u> |
|----------------------|------------------|------------------------|
| Copper               | 1/2" thru 4"     | CT-121                 |
| Steel                | 3/4" thru 20"    | 261                    |

K. Provide Grinnell Fig. 194, 195, or 199 steel wall brackets for piping suspended or supported from walls. Brackets shall be prime coated carbon steel.

L. Mount hangers for insulated piping on outside of pipe insulation sized to allow for full thickness of pipe insulation. Provide Grinnell Fig. 167 insulation protection shields sized so that line compressive load does not exceed one-third of insulation compressive strength. Shield shall be galvanized steel and support lower 180 degrees of pipe insulation on copper tubing. Provide wood block at each pipe hanger in thickness of insulation. Insulation vapor barrier jacket shall overlap wood block to maintain vapor barrier.

M. Structural attachments for pipe hangers shall be as follows:

Concrete Structure: Provide Grinnell Fig. No. 285 cast in concrete insert for loads up to 400 lbs. and Grinnell Fig. 281 wedge cast in type concrete insert for loads up to 1200 lbs.

- N. Provide Grinnell pipe hangers for horizontal single pipe runs as follows:

| <u>PIPE MATERIAL</u> | <u>PIPE SIZE</u> | <u>HANGER FIG. NO.</u>                                    |
|----------------------|------------------|---|
| Copper               | 1/2" thru 4"     | CT-65   |
| Steel                | 3/8" thru 4"     | 65  |
| Steel                | 5" thru 30"      | 260   |
| Steel                | 3" thru 8"       | 181 (provide 160 series pipe covering protection saddles) |

- O. Provide Fee and Mason Fig. 600 channel trapeze pipe hangers for horizontal multiple pipe runs with pipe clamps or pipe rollers as follows:

| <u>PIPE MATERIALS</u> | <u>PIPE SIZE</u> | <u>CLAMP NO.</u> | <u>ROLLER NO.</u> |
|-----------------------|------------------|------------------|-------------------|
| Copper                | 3/8" thru 4"     | 8600 CP*         | 8010 CP*          |
| Steel                 | 3/8" thru 6"     | 8500             | 8010              |

\*Copper Plated

- P. Pipe supports for horizontal piping mounted on pipe racks or stanchions shall be Advanced Thermal Systems low friction graphite slide supports or equivalent by Elcen or Grinnell. Where racks and supports are not detailed on drawings submit detailed support drawings to Architect-Engineer for review prior to fabrication.
- Q. Provide Fee and Mason Fig. 404 vibration control hangers at locations where piping vibrations would be transmitted to building structure by conventional hangers. Apply hangers within their load supporting range.
- R. Provide Elcen Fig. 50 pipe saddle with adjuster to support piping from floor. Provide complete with pedestal type floor stand.
- S. Provide necessary structural steel and attachment accessories for installations of pipe hangers and supports. Where heavy piping loads are to be attached to building structure verify structural loading with Architect-Engineer prior to installations.
- T. Equivalent hangers and supports by Auto-Grip, Basic Engineer, Bee Line, Elcen, Fee & Mason, Fluorocarbon Company, Unistrut or Super Strut Inc.
- U. Provide ANVIL series 163 or 164 pipe saddles for steel steam piping hangers and supports.
- V. Where wall pipe rack supports are not detailed or shown on the drawings submit detailed support drawings to Engineer for review prior to fabrication.

### 2.3 EQUIPMENT ANCHORS

- A. Provide floor or foundation mounted equipment such as pumps, boilers, air handling units, etc. with Decatur Engineering Company concrete anchors.
- B. Where equipment anchors cannot be installed during forming of floors or foundations anchor equipment with McCulloch Kwik-Bolt concrete anchors.
- C. Anchors shall be proper type and size recommended by manufacturer for equipment to be anchored.

END OF SECTION 230529

## SECTION 230553 - TESTING & BALANCING

### PART 1 - GENERAL (Reference Section 230500)

#### 1.1 GENERAL

A. Testing and balancing 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 agency to complete the job.

B. Acceptable Testing and Balancing Firms:

Energy Management and Control Corporation, Topeka, Kansas  
Allied Labs, Lawrence, Kansas  
Doyle Services, Lenexa, Kansas

#### 1.2 SYSTEM PREPARATION FOR TESTING AND BALANCING

A. Prior to requesting testing and balancing agency 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.

B. 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 agency and two to A/E. Testing and balancing agency will not begin until checklist has been received and reviewed.

##### 1. Air Handling Systems:

- a. Clear system of all foreign objects and clean system.
- b. Verify fan rotation.
- c. Check bearing condition and lubrication.
- d. Check fan wheel clearances and fan alignment.
- e. Check motor security to mounting base.
- f. Check alignment of drive.
- g. Check vibration isolator adjustment.
- h. Verify that proper filter media is installed.
- i. Verify that all control dampers are installed and operable without binding or sticking.
- j. Confirm that all fire, smoke and volume dampers are installed and in full open position.
- k. Verify that all air terminal units are installed. Confirm that all air openings in walls above ceilings have been provided.
- l. Check for and repair all excessive air leaks in duct systems, at equipment connections and at coils.
- m. Air leaks shall not exceed SMACNA parameters for system pressure.
- n. Verify that ductwork is constructed and installed in accordance with contract drawings and/or approved ductwork shop drawings.

##### 2. Hydronic Systems:

- a. Confirm pump shaft alignment, grouting and fastening of pump base.
- b. Verify that all pump vibration isolators are properly adjusted and that flexible connections are properly restrained and aligned.

- c. Check pump bearing for proper lubrication and condition.
  - d. Verify pump rotation and impeller size.
  - e. Confirm that total system has been hydrostatically tested, flushed, filled, vented and water treated as required.
  - f. Confirm that all strainer baskets are in place, clean and are the proper type.
  - g. Verify that all pressure reducing and control valves are operating properly.
  - h. Confirm that all expansion tanks are installed and contain proper air charge.
  - i. Verify that access to all balancing valves and flow stations in walls and ceilings have been provided.
  - j. Inspect and clean all coils and correct fin damage.
  - k. Confirm that fittings have been provided for flow and temperature measurements at all coils, heat exchangers and pumps.
  - l. Verify that all piping connections to 3-way valves and coils are proper for flow direction as indicated by manufacturer and temperature control contractor.
3. Boilers:
- a. Verify cleaning and start-up was in accordance with manufacturers recommendations and that all safety and operating controls have been tested, adjusted and set for proper operation. Submit start-up log with report.
  - b. Confirm that flow and temperature measurements devices have been provided.
- C. The Mechanical Contractor shall make changes in pulleys, belts, dampers, etc., as required by the test and balance agency, at no additional cost to the Owner.
- D. The Mechanical Contractor shall install new filters in the air handlers and clean all strainers in the water system just prior to the beginning of the testing and balancing.
- E. The control manufacturer or his representative shall assist the test and balance agency in setting automatic dampers, valves, etc., as required.
- 1.3 AIR AND WATER BALANCE
- A. The Contractor shall procure the services of an independent air balance and testing agency, 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 agency shall be done under engineer employed by them. All instruments used by this agency 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 firm shall be certified by NEBB or AABC and all work shall be performed in accordance with these organizations' published procedure manuals.
- B. 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.
- C. The Mechanical Contractor shall make changes in pulleys, belts, dampers, etc., as required by the test and balance agency, at no additional cost to the Owner.
- D. The Mechanical Contractor shall install new filters in the air handlers and clean all strainers in the

water system just prior to the beginning of the testing and balancing.

- E. The control manufacturer or his representative shall assist the test and balance agency in setting automatic dampers, valves, etc., as required.
- F. The balancing agency 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 agency shall submit 3 copies of this report to the Mechanical Contractor who shall submit them to the A/E for review and distribution.
- G. 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.
- H. The TAB firm 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 firm.
- I. During installation of the mechanical systems the testing and balancing agency 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 firm. Following each inspection visit the TAB firm 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 230553

## SECTION 230701 - DUCTWORK INSULATION

### PART 1 – GENERAL (Reference Section 230500)

### PART 2 – PRODUCTS

#### 2.1 DUCTWORK INSULATION

- A. Provide necessary materials and accessories for installation of interior and exterior ductwork insulation as specified and/or detailed on drawings. Insulation type and thickness for specific ductwork systems shall be as listed in insulation schedule in this section of specification. Provide insulation materials manufactured by Schuller, Knauf Fiberglass, Certain/Teed, or Owens-Corning Fiberglas.
- B. Insulation and application adhesives, except where specified otherwise, shall have fire and smoke hazard rating as tested by ASTM E-84 procedure not exceeding:

|                  |    |
|------------------|----|
| FLAME SPREAD     | 25 |
| SMOKE DEVELOPED  | 50 |
| FUEL CONTRIBUTED | 50 |

- C. Insulation shall meet ASTM C411 performance test and shall be installed in conformance with NFPA Standard 90A.
- D. Install interior duct liner insulation cut to insure tight fitting corner, and longitudinal joints. Apply liner to sheet metal with 100% coverage of adhesive applied in accordance with manufacturers recommended applications rate. Coat all edges of liner with adhesive. Provide mechanical fasteners on surfaces 18" or wider in addition to liner adhesive with fastener clips set flush with duct liner surface. Provide fasteners as follows:
1. Low Velocity Ductwork (Velocities less than 2000 FPM): Provide fasteners within 3" of leading edge of each section 12" O.C. around joint perimeter and 3" from longitudinal joints 12" O.C. Elsewhere space fasteners 18" O.C. except not more than 6" from longitudinal joints and not 12" from corner break.
- E. Provide round sheet metal ductwork with exterior thermal insulation of type and thickness listed in insulation schedule. Apply insulation with joints tightly butted together with longitudinal and end joint strips sealed with vapor barrier adhesive. Insulate fittings with insulation thickness equal to adjoining insulation with cover overlapping 2" onto adjacent covering.
- F. Eliminate ductwork insulation on exposed round ductwork unless noted otherwise in ductwork insulation schedule.
- G. Duct insulation materials by type shall be as follows:
1. Type 1-DIL: Internal acoustical and thermal duct insulation for low and high velocity ductwork shall be 2 lb. density for 1/2" thick and 1.5 lb. density for 1" thick duct liner with 1.08 @ 1000 FPM friction coefficient and .24 BTUH thermal conductivity at 75 degrees mean temperature.
  2. Type 2-DEW: External thermal insulation for low, medium and high pressure duct shall be 1.0 lb. density standard duct insulation type IV with foil-scrim-craft facing and .27 BTUH thermal conductivity at 75 degrees mean temperature.
  3. Type 3-DEW: External thermal insulation for low pressure ductwork. Fiberglass with .23 Btuh thermal conductivity at 75°F mean temperature and fire retardant polyethylene .003" thick jacket. Insulation shall be premanufactured sleeve type

- for installation over round low velocity ductwork.
4. Type 4-DEW: External fire insulation for grease ducts to provide a 2-hr. fire resistance rating shall be Pabco Super Firetemp-L. Install as per manufacturer's recommendation. Equivalent by 3M ductwrap, provide (2) 1½" layers.
  5. Type 5-DIL: **R-8** ThermaDuct OD, 1-3/16" thick panel
 

|                            |  |
|----------------------------|--|
| Color:                     | Polar white with reflective sheen.   |
| Density:                   | Shell offers a tensile strength of 6,350 psi   |
| Flammability:              | Core: Kingspan KoolDuct, 25/50<br>complaint  |
|                            | Shell: V-0 per UL-94   |
| Thermal Conductivity:      | K = 0.146 BTU/in/ft²/hr./degree F  |
| Minimum R-value:           | R-8.1 both of package and installed  |
| Temperature Limits:        | Interior; 185 F, Exterior; 165 F   |
| Closed Cell Content:       | >90%   |
| Vapor Barrier:             | Autohesively bonded aluminum foil with<br>zero permeability 1000 micron UV stable<br>vinyl |
| Fire/Smoke<br>Performance: | UL 723 Flame spread / smoke development<br>interior <25/50                                 |

Contractor option for field applied Armatuff flexible elastomeric thermal insulation with 12 mil laminated metal cladding

Contractor option for field applied Armacell: Armatuff flexible 2" (R-8) elastomeric thermal insulation with 17.5 mil laminated metal cladding, or equivalent.

H. Specific insulation materials and installation methods for ductwork systems shall be as follows:

| <u>DUCTWORK SYSTEM</u>     | <u>TYPE</u> | <u>DUCT INSULATION THICKNESS</u> |
|----------------------------|-------------|----------------------------------|
| Supply Air                 | 2-DEW       | 1-1/2"                           |
| Kitchen (grease) Hood Duct | 4-DEW       | (2) 1-1/2"                       |

END OF SECTION 230701

## SECTION 233113 - DUCTWORK

### PART 1 - GENERAL REQUIREMENTS (Reference Section 230500)

#### 1.1 GENERAL

- A. Construct ductwork as detailed on drawings and as detailed in the latest edition of the Sheet Metal and Air Conditioning Contractor's Association (SMACNA) Duct Manual. Details shown on project plans shall indicate specific construction methods to be used on this project, and shall be used in lieu of any alternate methods shown in SMACNA Duct Manual.
- B. Construct and install ductwork to be completely free from vibration under all conditions of operation. Support and securely anchor ductwork and equipment from structural framing of building. Provide suitable intermediate metal framing where required between building structural framing.
- C. Construct ductwork in accordance with operating static pressure range. Ductwork pressure classifications shall be as follows:
  - 1. Low Pressure Ductwork: System operating static pressure 1.5" positive or negative of W.G. or less and velocities less than 2500 FPM.
  - 2. High Pressure Ductwork: System operating static pressure 3" positive or negative of W.G. or less and velocities less than 4500 FPM.
- D. All metal ductwork scheduled for interior thermal and acoustical liner is not sized on plans to include the proper thickness of insulation. Increase height and width of ductwork as required to accommodate insulation thickness. Mount specialties such as turning vanes, campers, etc., to ductwork with that section insulated "Build Outs" to maintain continuity of thermal barrier.
- E. Construct low pressure system ductwork to conform to latest edition of low pressure duct construction standards of SMACNA Duct Manual.
- F. Construct medium and high pressure system ductwork to conform to latest edition of high pressure duct construction standards of SMACNA Duct Manual.
- G. Provide spiral wound duct on all round ductwork greater than 10" dia. Provide longitudinal seam duct on all round ductwork 10" dia or less.
- H. Sealing of low and high pressure ductwork shall be as follows:
  - 1. Option #1: Low and high pressure ductwork: Including supply, return and exhaust. Provide Hard Cast, Inc. "Duct Seal 321" fiber reinforced water based duct sealant in accordance with manufacturers' directions on all joints, connectors, etc.
  - 2. Option #2: Low and high pressure rectangular ductwork: Provide "Ductmate" systems as manufactured by Ductmate Industries, Inc. or an approved equal system.

### PART 2 – PRODUCTS

#### 2.1 RECTANGULAR STEEL

- A. Provide new commercial quality, bright spangled galvanized sheet steel manufactured in the U.S.A.

2.2 INSTALLATION

- A. All ductwork shall be installed in strict accordance with latest edition of SMACNA "HVAC Duct Construction Standards".

2.3 TYPE 1 - HOOD EXHAUST DUCT

- A. Provide 16 ga. black steel duct with welded joints.
- B. Slope duct toward hood.
- C. Provide access doors at all elbows or changes in direction.

END OF SECTION 233113

## SECTION 233300 - DUCTWORK ACCESSORIES

### PART 1 – GENERAL (Reference Section 230500)

### PART 2 – PRODUCTS

#### 2.1 SHEET METAL SPECIALTIES

- A. Specialties shall be factory fabricated items designed for low, medium or high velocity systems as required. Submit shop drawings on all specialties required with shop drawings of ductwork layout. Specialties shall be as follows:
1. Turning Vanes: High Pressure Aero/Dyne or equal 26 gauge H-E-P high efficiency profile air foil vanes mounted 2-1/8" on center on 24 gauge runners. Air turns by Barber-Coleman will be acceptable on low pressure only. Note: Turning vanes to be provided on all supply, return and exhaust ducts.
  2. Extractors (Low Velocity): Carnes #1250 all aluminum air volume extractor. Unit shall be adjustable from full open to full closed position. Provide channel supports where recommended by manufacturer (length over 16", height over 8"). Provide Young end bearings and rod with regulator as hereinafter specified. Equivalent by Price.
  3. Dampers: Provide 24 gauge minimum galvanized metal blades supported on duct with metal supports and locked in position with locking type damper arm by Carnes, Greenheck, Air Balance, Louvers & Dampers, FAP, Pottorff and Cesco
  4. Backdraft Dampers: Unless backdraft dampers are specified with a particular piece of equipment. Provide Cesco #BDA or equal with 16 gauge aluminum blade with oiled bearings mounted in steel frame. Blades shall be balanced and connected with tie bar. Provide end seals and blade seals. Equivalent by Ruskin, Greenheck, Air Balance, Air Stream, Titus, Louvers & Dampers, FAP, Pottorff and Cesco.
  5. Backdraft dampers: Where backdraft dampers are shown on plans installed behind wall louvers or roof relief vents, provide Cesco #BDA-101-H heavy-duty construction counter balanced to assist air flow complete with end seals and blade seals. Equivalent by Ruskin, Greenheck, Air Balance, Air Stream or Titus, Louvers & Dampers, FAP.
  6. Flexible Connections: Metaledge Ventglas prefabricated flexible connection of 3-1/4" wide heat and fire resistant neoprene coated glass fabric with two 3" wide 24 gauge metal strips attached to each edge. Vent Fabrics, Inc., Duro-dyne Corp. or equal.
  7. Access Doors: Provide access doors in ductwork ceiling, walls, or floors for access to ductwork valves, controls, piping etc., installed under this contract. Doors and frame shall be formed of not lighter than USS #14 gauge and #16 gauge steel, respectively. Hinges shall be concealed loose pin spring type. Locks shall be flush, screwdriver, cam action type. Doors and frames shall be furnished in prime coat of Higgins, Milcor, Donley or equal.
  8. Round take-off fittings: Round take-off fittings to medium and high pressure rectangular ductwork in sizes 12" and larger shall be made with Wesco bell mouth fittings or approved equal. Factory fabricated 90 degree conical tees or 45 degree tees with 1/2" flange acceptable.
  9. Round take-off fittings: Round take-off fittings from supply diffusers or registers to low pressure supply ductwork shall be Flexmaster #FLDE complete with locking damper and air scoop. Equivalent by Atco, Air Control Products.
  10. Smoke Dampers: Prefco Model #5020 motorized fire/smoke damper. Power open, locked and reset, spring closed.
  11. Equivalent by Ruskin, Nailor, Greenheck, Air Balance.

12. Equivalent by Wiremold, Cleavaflex, Flexmaster.
13. Low Pressure Flexible Duct: Thermaflex GK-M rated for +6" W.G. max. and -1" W.G. max. for duct sizes 4" to 14", +6" W.G. max. and -0.5" W.G. max for duct sizes 14" to 16", +4" W.G. max. and -0.5" W.G. max for duct sizes 18" to 20". Rated for 3500 FPM maximum velocity. UL listed "UL-181 Standards Class I Duct Material" complying with NFPA Standards 90A and 90B. Duct shall be composed of an acoustically rated inner polymeric liner duct bonded to coated steel wire helix. Fiberglass insulation and tear resistant metalized polyester flim outer vapor barrier.
14. Equivalent by Wiremold, Cleavaflex, Flexmaster.
15. Ruskin and IAC shall be considered equivalent duct silencers.
16. Fire Dampers: Greenheck "FD-150X" low profile 1 1/2 hr rated, UL555. Stacked blade design for minimum reduction of cross sectional area of penetrations and ducts. 165 degree fusible link.
  - a) Equivalent by Nailor, Greenheck, Ruskin, Air Balance.
17. Combination fire/smoke damper:
  - a) Greenheck model: FSD-212 combination fire smoke damper.
    - Galvanized 3-Vee Style Blades.
    - UL 555S Leakage Class II.
    - UL 555 1-1/2 Hour Fire Resistance Rating.
  - b) Honeywell ML402 Actuator, 120VAC
  - c) Greenheck model: RRL Resettable Link, 165 degree setting, electric sensor thermostat.

## 2.2 INSTALLATION

- A. All ductwork accessories shall be installed in strict accordance with the manufacturer's requirements SMACNA, NFPA 90A and 90B, UL listings and drawing details.

END OF SECTION 233300

## SECTION 233416 - EXHAUST FANS

### PART 1- GENERAL (Reference Section 230500)

#### 1.1 GENERAL REQUIREMENTS

- A. Provide where shown on plans exhaust fans as hereinafter specified. Reference the exhaust fan schedule on plans for performance and other requirements only.
- B. Equivalent by Greenheck, Twin City, Cook, and Carnes.

#### 1.2 CENTRIFUGAL EXHAUST FANS

- A. Exhaust fans shall be upblast centrifugal belt driven type. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure. Windbands shall have a rolled bead for added strength and shall be joined to curbcaps with a welded seam.
- B. Motors shall be heavy duty ball bearing type, carefully matched to the fan load, and furnished at the specified voltage, phase and enclosure. Motors and drives shall be mounted on vibration isolators, out of the airstream.
- C. Fresh air for motor cooling shall be drawn into the motor compartment from an area free of discharge contaminants.
- D. Motors shall be readily accessible for maintenance and a means of inspecting, cleaning and servicing the exhaust fan.
- E. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators.
- F. Precision ground and polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings.
- G. Bearings shall be selected for a minimum of 150% of driven horsepower.
- H. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
- I. Motor pulleys shall be adjustable for final system balancing.
- J. A disconnect switch shall be factory installed and wired from the fan motor to a junction box installed within the motor compartment.
- K. Provide 14" high curbs sloped for pitch of roof.
- L. A conduit chase shall be provided through the curb cap to the motor compartment for ease of electrical wiring.
- M. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.
- N. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.

END OF SECTION 233416

## SECTION 237400 – MAKE-UP AIR UNITS

### PART 1 – GENERAL (Reference Section 230500)

#### 1.1 SUMMARY

A. This section includes Units with integral Heating. Integral heating source shall be Electric heating. Airflow arrangement shall be Outdoor Air only. Each unit shall be constructed in a horizontal configuration and shall incorporate additional product requirements as listed in Part 2 of this specification.

B. Related sections include the following:

1. Division 1 specifications
2. Division 23 specifications
3. Division 26 specifications

#### 1.2 SUBMITTALS

A. Product Data: For each type or model, include the following:

1. Complete fan performance curves for Supply Air, with system operating conditions indicated, as tested in an AMCA Certified Chamber.
2. Sound performance data for Supply Air, as tested in an AMCA Certified chamber.
3. Motor ratings, electrical characteristics and motor and fan accessories.
4. Dimensioned drawings for each type of installation, showing isometric and plan views, to include location of attached ductwork and service clearance requirements.
5. Estimated gross weight of each installed unit.
6. Installation, Operating and Maintenance manual (IOM) for each model.

#### 1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain Packaged Make-Up Air Unit with Integral Heating with all appurtenant components or accessories from a single manufacturer.

B. Product Options: Drawings must indicate size, profiles and dimensional requirements of Make-Up Air Units and are to be based on the specific system indicated. Refer to Division 1 Section "Product Requirements".

C. Certifications:

1. Entire unit shall be ETL Certified per UL 1995 and bear an ETL mark
2. Coils shall be Recognized Components per UL 1995, CAN/CSA C22.2 No. 236.05. Coil performance shall be calculated in accordance with AHRI 410.

#### 1.4 COORDINATION

A. Coordinate size and location of all building penetrations required for installation of each Make-Up Air Unit and associated ducting, plumbing and electrical systems.

B. Coordinate sequencing of construction of associated plumbing, HVAC, and electrical supply.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with specifications contained within this document, manufacturers offering products that may be incorporated into the work include, but are not limited to:

1. Greenheck Fan Corporation
2. Equal by Reznor, Modine, Engineered Air, or Cambridge

### 2.2 MANUFACTURED UNITS

A. Unit with Integral Heating shall be fully assembled at the the factory and consist of an insulated metal cabinet, an outdoor air intake weatherhood with aluminum mesh, sensors, curb assembly, motorized intake damper, supply air blower assembly, electrical control center. All specified components and internal accessories factory installed and tested and prepared for single-point high voltage connection.

### 2.3 CABINET

A. Materials: Formed, double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.

1. Outside casing: 18 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. Pre-painted components as supplied by the factory shall have polyester urethane paint on 18 gauge G60 galvanized steel. Base rail is 12 gauge, galvanized (G90) steel.
2. Internal assemblies: 24 gauge, galvanized (G90) steel except for motor supports which shall be a minimum 14 gauge galvanized (G90) steel.

B. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.

1. Materials: Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.
  - a. Thickness: 1 inch (25 mm)
  - b. Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.
  - c. Location and application: Floor of each unit shall be insulated with fiberglass insulation. Full interior coverage from "Heating on".

C. Access panels: Unit shall be equipped with insulated removable access panels to provide easy access to all major components. Access panels shall be fabricated of 18 gauge galvanized G90 steel. Removable access panels shall incorporate a formed drip edge.

D. Supply Air blower assembly options: Forward curve blower: Blower assembly consists of an electric motor and a belt driven, double width, and double inlet forward curve blower. Assembly shall be mounted on heavy gauge galvanized rails and further mounted on minimum 1.125 inch thick neoprene vibration isolators.

E. Control center / connections:

1. Unit shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections.

F. Electric heat: Electric heater is to be UL listed with open coil elements. Heater control cabinet is to be installed within the units heating section. Electric heater is to be provided with SCR controls. Electric heater is to be controlled off of VernierSCR. Units with electric heat are to be provided with a center that shall be constructed to permit single-point high voltage power supply connections.

G. Motorized Inlet Air Damper: to be of low leakage type and shall be factory installed.

H. Sensors are considered to be part of various optional operational modes or device controllers and are to be factory supplied and installed as specified by the A/E.

I. Curb Assembly: A curb assembly shall be made of galvanized steel provided by the factory for field assembly and installation as part of this division. The curb shall include a duct adapter(s) for supply air. The installing contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration. Contractor shall provide and install appropriate insulation for the curb assembly.

#### 2.4. BLOWER-FC

A. Blower section construction, Supply Air: Belt drive motor and blower shall be assembled onto a minimum 14 gauge galvanized steel platform and must have neoprene vibration isolation devices, minimum of 1-1/8 inches thick.

B. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.

C. Centrifugal blower housing: Formed and reinforced steel panels to make curved scroll housing with shaped cutoff.

D. Forward curved blower (fan) wheels: Galvanized or aluminum construction with inlet flange and shallow blades curved forward in direction of airflow. Mechanically attached to shaft with set screws.

E. Blower section motor source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".

#### 2.5. MOTORS

A. General: Blower motors greater than 3/4 horsepower shall be "NEMA Premium" unless otherwise indicated. Compliance with EPA minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure. Drives shall be sized for a minimum of 150% of driven horsepower and pulleys shall be fully machined cast-type, keyed and fully secured to the fan wheel and motor shafts. Electric motors of ten horsepower or less shall be supplied with an adjustable drive pulley. Comply with requirements in Division 23 05 13, matched with fan load.

- B. Motors shall be 60 cycle, 3 phase, 230 volt.

## 2.6. UNIT CONTROLS

- A. The unit shall be constructed so that it can function as a stand-alone heating system controlled by factory-supplied remote panel, thermostats and sensors or it can be operated as a heating system controlled by a Building Management System (BMS).
- B. Sensors to be provided with the unit:
  - 1. Heating Inlet Air Sensor
  - 2. Discharge Air temperature control.

## 2.7. FILTERS

- A. Unit shall have 2" thick permanent metal filters following the outdoor air intake in a V-bank arrangement and shall be accessible from the exterior of the unit.

## PART 3 – EXECUTION

### 3.1. EXAMINATION

- A. Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.
- B. Proceed with installation only after all unsatisfactory conditions have been corrected.

### 3.2. INSTALLATION

- A. Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer's installation instructions as documented in manufacturer's IOM, Best Practices and all applicable building codes.

### 3.3. CONNECTIONS

- A. In all cases, industry Best Practices shall be incorporated. Connections are to be made subject to the installation requirements shown above.
  - 1. Piping installation requirements are specified in Division 22 (Plumbing). Drawings indicate general arrangement of piping, fittings and specialties.
  - 2. Duct installation and connection requirements are specified in Division 23 of this document.
  - 3. Electrical installation requirements are specified in Division 26 of this document.

### 3.4. FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to A/E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM.

### 3.5. START-UP SERVICE

- A. Engage a factory authorized service representative to perform startup service. Clean entire unit, comb coil fins as necessary, and install clean filters. Verify water source for compliance with manufacturer's requirements for flow and temperature. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing and Balancing" and comply with provisions therein.

### 3.6. DEMONSTRATION AND TRAINING

- A. Engage a factory authorized service representative to train owner's maintenance personnel to adjust, operate and maintain the entire Make-Up Air unit. Refer to Division 01.

END OF SECTION 237400

## SECTION 237500 – TYPE 1 KITCHEN HOODS

### PART 1 – GENERAL (Reference Section 230500)

Kitchen Ventilation hood(s) shall be of the Type I, exhaust only wall canopy suitable for all types of cooking applications. The hood(s) shall be U.L. 710 Listed without a fire damper (with optional) for 400°F, 600°F, or 700°F rated cooking appliances. Please visit [www.ul.com](http://www.ul.com) for U.L. 710 listing for performance and size options. Make-up air shall be independently provided.

The hood(s) exterior shall be constructed of a minimum of 18 gauge 400 series stainless steel (300 series optional). The hood(s) shall be constructed using the standing seam method for optimum strength and with a Performance Enhancing Lip (PEL) to improve capture efficiency by turning air back into the hood. Front panels shall be of double wall construction with 1 inch insulation to add additional strength and rigidity. An integral 3 inch air space is provided to meet NFPA® 96 clearance requirements against limited combustible walls. Integral 3 inch air space may be omitted for non-combustible construction. All seams, joints and penetrations of the hood enclosure shall be welded and/or liquid tight. Lighter material gauges, alternate material types and finishes are not acceptable. All unexposed interior surfaces shall be constructed of a minimum 18 gauge corrosion resistant steel including, but not limited to ducts, plenum, and brackets.

The hood(s) shall include a filter housing constructed of the same material as the hood. The Grease-X-Tractor high efficiency stainless steel filters shall be U.L. 1046 Classified and NSF Certified as manufactured by Greenheck, in sufficient number and sizes to ensure optimum performance. Grease-X-Tractor filters shall direct the exhaust airflow through individual cyclone chambers, utilizing centrifugal impingement grease extraction technology. The filter housing shall terminate in a pitched, full length grease trough which shall drain into a removable grease container. These filters shall have a grease removal efficiency of 69% at 8 microns (51% from 3-10 microns) and static pressure drop of 0.7-0.8 in. WC.

Vapor proof, U.L. Listed incandescent light fixtures shall be pre-wired to a junction box located at the top of the hood for field connection. Wiring shall conform to the requirements of the NFPA® 70. Contractor to provide LED bulbs.

The canopy hood(s) shall be constructed by Greenheck. They shall be built in accordance with the NFPA® 96, IMC, UMC, and bear the NSF Seal of Approval. The hood manufacturer shall provide, on request, the necessary data that confirms compliance with the code authorities listed above.

Refer to plans for additional requirements.

Provide fully compliant hood suppression system.

END OF SECTION 237500