



# LABETTE COUNTY

## Unified School District 506

P. O. Box 189 • 401 S. High School Street • Altamont, KS 67330  
(620) 784-5326 • Fax: (620) 784-5879

"Where Excellence and  
Education Meet"

[www.usd506.org](http://www.usd506.org)

December 1, 2022

### NOTICE OF INVITATION FOR BIDS

Written sealed bids will be received by the Board of Education of Unified School District No. 506, Labette County Public Schools, Kansas at the office of the Board of Education, located at 401 South High School Street, Altamont, Kansas on the 2nd day of February 2023 by 9:00 a.m. The bid opening will be at 9:05 a.m.

There are 5 separate projects for this invitation for bids. Contractors may bid any or all of them.

**HVAC Upgrades Altamont Grade School, 705 6<sup>th</sup> St, Altamont, KS 67330**

**HVAC Upgrades Bartlett Grade School, 201 2<sup>nd</sup> St, Bartlett, KS 67332**

**HVAC Upgrades Edna Grade School, 220 Myrtle St. Edna, KS 67342**

**HVAC Upgrades Meadow View Grade School, 1377 21000 Rd, Parsons, KS 67357**

**HVAC Upgrades Mound Valley Grade School, 402 Walnut St. Mound Valley, KS 67354**

Specifications may be obtained by contacting district Maintenance Director Brent Barragar at 620-778-2143.

Before any bid is considered for the award, the bidder may be requested by the school district to submit a statement regarding its previous experience in performing such comparable work, its business and technical organization, its financial resources, and labor available to be used in performing the work.

Bids should be sealed, marked appropriately "Heating and Cooling Loop System", and addressed to Clerk of the Board of Education, Unified School District No. 506, Labette County Public Schools, Altamont, Kansas. Failure to do so may result in a premature opening of or failure to open such a bid. No bids will be received after 9:00 a.m. on February 2, 2023. Faxed or emailed bids are acceptable. Email bids shall be emailed to Cindy Dean at [cindydean@usd506.org](mailto:cindydean@usd506.org) or faxed to 620-784-5879.

Bids will be received on the attached bid form which shall indicate clearly the total amount of money to be paid to the school district or to be received from the school district for the performance of the work under the terms and conditions as described in this Notice.

Bids submitted prior to the time of bid opening may be withdrawn by written facsimile or telegraphic request. Bids that are withdrawn may be changed and resubmitted, provided they are received prior to the time set for opening of the bids. All bids will be publicly opened at the time set for opening specified in this notice. Each bid shall be subject to acceptance or rejection by the board within 15 working days following the bid opening. The bidder whose bid is accepted will, within the time established in the bid, enter into a written contract with the school district. The Board retains the right to reject any or all bids.

For further information or details, please contact Brent Barragar at 620-778-2143. Contractors are encouraged to perform a site visit prior to submitting a bid. Please contact Brent Barragar at the number listed above to schedule a visit. The successful vendor will be notified no later than Feb 16, 2023, after a Board of Education meeting.



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John Wyrick  
Superintendent of Schools  
Labette County, USD 506

### Specifications

Contractor to provide and comply with the following items:

The proposal must meet the minimum options and performance listed. Any deviations must be clearly noted in order to be considered for evaluation.

- Work shall be completed according to the attached mechanical and electrical plans and specifications prepared by PKMR Engineers, contact Scott McKinley, PE [scott.mckinley@pkmreng.com](mailto:scott.mckinley@pkmreng.com) 785-633-7889 with questions.
- Remove and dispose of all the heating and cooling equipment shown on the plans.
- Install all new HVAC equipment. Owner will be pre-purchasing the main HVAC equipment as noted in the equipment schedules on the plans.
- Contractor to provide all ductwork, piping, flues, refrigerant, insulation, installation, electrical, and control work.
- The contractor is responsible for removing and replacing the ceiling grid in areas where needed to complete the work.
- Remove and dispose of all asbestos found on all heating and cooling piping that is to be removed during the project.
- All bidders are encouraged to perform a site visit prior to submitting a bid.

#### **Successful Bidder Agrees to the following Assurances set forth by Kansas State Department of Education:**

1. Davis-Bacon Prevailing Wage Requirements-
  - a. Contractors must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor.
  - b. Contractors must be required to pay wages not less than once a week.
  - c. District must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation.
  - d. Contract must also include a provision for compliance with the Copeland "Anti-Kickback" Act (40 U.S.C. 3145),
  - e. District must report all suspected or reported violations to the Federal awarding agency.
2. Assessment of Environmental Impact-
  - a. District shall include with its application its assessment of the impact of the proposed construction on the quality of the environment in accordance with section 102(2)(C) of the National Environmental Policy Act of 1969 and Executive Order 11514 (34 FR 4247).
3. Contract Work Hours and Safety Standards Act-



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- a. Contracts must include a provision for compliance with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5).
  - b. Contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard workweek of 40 hours.
  - c. Work in excess of the standard workweek is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the workweek.
  - d. No laborer or mechanic must be required to work in surroundings or under working conditions that are unsanitary, hazardous, or dangerous.
4. Preservation of Historic Sites Must Be Described in the Application-
- a. District shall describe in its application the relationship of the proposed construction to and probable effect on any district, site, building, structure, or object that is: (1) Included in the National Register of Historic Places; or (2) Eligible under criteria established by the Secretary of Interior for inclusion in the National Register of Historic Places.
5. Comply With Safety and Health Standards-
- a. In planning for and designing facilities, a grantee shall observe: (a) The standards under the Occupational Safety and Health Act of 1970 (Pub. L. 91-576) (See 36 CFR part 1910)
6. Supervision and Inspection by the Grantee-
- a. A grantee shall maintain competent architectural engineering supervision and inspection at the construction site to ensure that the work conforms to the approved drawings and specifications.
7. Energy Conservation-
- a. District shall design and construct facilities to maximize the efficient use of energy.
  - b. See the following standards of the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE): (1) ASHRAE-90 A-1980 (Sections 1-9); (2) ASHRAE-90 B-1975 (Sections 10-11); (3) ASHRAE-90 C-1977 (Section 12).
8. Equal Employment Opportunity-
- a. Must include the equal opportunity clause provided under 41 CFR 60-1.4(b), in accordance with Executive Order 11246, "Equal Employment Opportunity" (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."
9. Clean Air Act and the Federal Water Pollution Control Act-
- a. Contracts and subgrants of amounts in excess of \$150,000 must contain a provision that requires the non-Federal award to agree to comply with all applicable standards, orders, or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387).
  - b. Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).
10. Debarment and Suspension-
- a. A contract award must not be made to parties listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), "Debarment and Suspension." SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties



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declared ineligible under statutory or regulatory authority other than Executive Order 12549.

11. Byrd Anti-Lobbying Amendment-

a. Contractors that apply or bid for an award exceeding \$100,000 must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award.

USD #506 reserves the right to refuse any bids for any reason and may select any bid that is deemed to best fit their needs.



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### BID FORM

Bid amount for:

HVAC Upgrades Altamont Grade School, 705 6th St, Altamont, KS 67330 \_\_\_\_\_

\_\_\_\_\_  
HVAC Upgrades Bartlett Grade School, 201 2nd St, Bartlett, KS 67332 \_\_\_\_\_

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HVAC Upgrades Edna Grade School, 220 Myrtle St. Edna, KS 67342 \_\_\_\_\_

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HVAC Upgrades Meadow View Grade School, 1377 21000 Rd, Parsons, KS 67357 \_\_\_\_\_

\_\_\_\_\_  
HVAC Upgrades Mound Valley Grade School, 402 Walnut St. Mound Valley, KS 67354 \_\_\_\_\_

\_\_\_\_\_  
Company: \_\_\_\_\_

\_\_\_\_\_  
Address \_\_\_\_\_

\_\_\_\_\_  
Telephone: \_\_\_\_\_

\_\_\_\_\_  
Email: \_\_\_\_\_

\_\_\_\_\_  
Contact Person: \_\_\_\_\_

\_\_\_\_\_  
Signature: \_\_\_\_\_



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Date: \_\_\_\_\_

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**SECTION 15010 - MECHANICAL 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 Mechanical 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 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. 2949 SW Wanamaker Dr, Topeka, KS 66614, PHONE 785-273-2447, 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. Equivalentents 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. TEMPORARY USE OF PERMANENT HVAC UNITS

If the Contractor elects to use permanent equipment for temporary conditioning only that permanent equipment associated with the heating system shall be allowed for use as space conditioning during the construction period. The Mechanical Contractor shall take full responsibility for all permanent equipment used for temporary conditioning during the construction period and shall provide a total of two years warranty covering all parts and labor on all permanent equipment utilized for temporary conditioning. This warranty shall cover all piping, fittings, valves, pipe and equipment insulation, pumps, boilers, chillers, condensing units, cooling towers, air handling units, exhaust and relief air fans, ductwork, ductwork insulation, diffusers, temperature controls, all electric motors, starters, disconnect switches, fuses, wire and conduit. This warranty shall cover all

required maintenance on the system with the exception of filter changes, and shall start on the date shown on the final completion certificate.

CAUTION: The Contractor is being warned that the Architect-Engineer will not accept dirty equipment caused by construction contamination.

#### 1.14. 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.

#### 1.15. ARCHITECTURAL VERIFICATION AND RELATED DOCUMENTS

Contractor shall consult all Architectural Drawings and specifications in their entirety incorporating and certifying all millwork, furniture, and equipment rough-in including utility characteristics such as voltage, phase, amperage, pipe sizes, duct sizes, including height, location and orientation. Shop drawings incorporating these requirements should be submitted to the Architect for approval prior to installation or rough in.

#### 1.16. 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 16, 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.

### 1.17. WORK NOT INCLUDED IN CONTRACT

Consult Division 16 of specifications for work to be provided by Electrical Contractor in conjunction with installation of mechanical equipment.

### 1.18. 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.

#### 1.18.1. CODES:

International Building Code

International Fire Code

International Mechanical Code

International Plumbing Code

National Electrical Code

Americans with Disabilities Accessibility Guidelines (ADAAG).

#### 1.18.2. UNIFORM CODES:

Uniform Plumbing Code - Western Plumbing Officials.

Uniform Mechanical Code - International Conference of Building Officials.

Uniform Building Code - International Conference of Building Officials.

#### 1.18.3. SAFETY CODES:

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

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

#### 1.18.4. NATIONAL FIRE CODES:

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

#### 1.18.5. UNDERWRITERS LABORATORIES INC:

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

#### 1.18.6. 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. SHOP DRAWINGS**

Contractor shall furnish a minimum of six sets of shop drawings of all materials and equipment. Architect-Engineer will retain three sets.

Contractor shall submit two sets of prints of all fabrication drawings. Cost of drawing preparation, printing and distribution shall be paid for by the contractor and included in his base bid.

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 each submitted item with applicable section and sheet number of these specifications, or plan sheet number when item does not appear in the specifications. Where equipment submitted does not appear in base specifications or specified equivalent, mark submittals with applicable alternate numbers, change order number or letters of authorization. Each submittal shall contain at least two sets of original catalog cuts. Each catalog sheet shall bear the equipment manufacturer's name and address. All shop drawings on materials and equipment listed by UL shall indicate UL approval on submittal.

Contractor shall check all shop drawings to verify that they meet specifications and/or drawings requirements before forwarding submittals to the Architect-Engineer for their review. All shop drawings submitted to Architect-Engineer shall bear contractor's approval stamp that shall indicate that Contractor has reviewed submittals and that they meet specification and/or 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 their supplier for re-submittal.

No shop drawing submittals will be considered for review by the Architect-Engineer without Contractor's approval stamp, or that have extensive changes made on the original submittal as a result of the Contractor's review.

The shop drawing submittal dates shall be at least as early as required to support the project schedule and shall also allow for two weeks Architect-Engineer review time plus mailing time plus a duplication of this time for re-submittal if required. Submittal of all shop drawings as soon as possible before construction starts is preferred. Submit the number of shop drawings required by the General Conditions but not less than 6 copies. All shop drawings submitted shall contain the following: The project name, the applicable specification section and paragraph, the submittal date, the Contractor's stamp which shall certify that the stamped drawings have been checked by the Contractor, comply with the drawings and specifications and have been coordinated with other trades. Submittals not so identified will be returned without action for re-submittal.

The Architect's-Engineer's checking and subsequent approval of such drawings, schedules, literature, or illustrations shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications unless he has, in writing, called the Architect's-Engineer's attention to such deviations at the time of submission, and secured their written approval; nor shall it relieve the contractor from responsibility for errors in dimensions, details, size of members, or omissions of components for fittings; or for coordinating items with actual building conditions and adjacent work.

Any corrections or modifications made by the Architect-Engineer shall be deemed acceptable to the Contractor at no change in price unless written notice is received by the Architect-Engineer prior to the performance of any work incorporating such corrections or modifications.

Shop drawings that require re-submission shall have the items that were revised "flagged" or in some other manner marked to call attention to what has been changed.

Before submitting shop drawings and material lists, verify that all equipment submitted is mutually compatible and suitable for the intended use. Verify that all equipment will fit the available space and allow ample room for maintenance. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.

Sheet metal shop drawings for duct fabrication shall be a minimum of 1/4" scale. Sheet metal shop drawings shall not be a reproduction of the contract document and shall show details of the following: Fabrication, assembly, and installation, including plans, elevations above finished floor, sections, components, and attachments to other work. Duct layout indicating pressure classifications and sizes on plans, fittings, reinforcement and spacing, seam and joint construction, penetrations through fire-rated and other partitions, hangers and supports, including methods for building attachment, vibration isolation, seismic restraints, and duct attachment.

Architect-Engineer's review of shop drawings will not relieve Contractor of responsibility for deviations from drawings and specifications unless the Architect-Engineer has specifically approved such deviations in writing, nor shall it relieve the Contractor of responsibility for errors in shop drawings. No work shall be fabricated until Architect-Engineer's review has been obtained. Any time delay caused by correcting and re-submitting shop drawings will be the Contractor's responsibility.

### 3.2. SUBMITTALS

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

#### SECTION 15600 - HVAC AIR SIDE EQUIPMENT:

Air handling units, Variable air volume boxes, Blower coil units, Furnaces, evaporators & condensing units, Rooftop heating and cooling units, Split system heat pumps, Gas fired unit heater, Through wall units, Condensing units, Ground source heat pumps, Ground source well loops, Indirect gas-fired make-up air handling unit, Exhaust fans, Air filters and housings, Rooftop heat pump units, Open coil duct heaters, Makeup air units, Duct furnaces

Vibration isolation, Isolation of piping systems, Isolation of fractional horsepower equipment

#### SECTION 15990 - SYSTEM TESTING & BALANCING:

Balance Report

### 3.3. 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.

### 3.4. 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.

### 3.5. 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.

### 3.6. 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.

### 3.7. 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.

### 3.8. 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.

### 3.9. 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 15010



**SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS****1. PART 1 - GENERAL****1.1. RELATED DOCUMENTS**

Reference Section 15010. 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. TEST METHODS AND PRESSURES**

Test methods and pressures shall be as follows:

**3.3. Pneumatic Test:**

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.

Curing test, completely isolate entire system from compressor or other sources of air pressure.

**3.4. 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.

### 3.5. 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.

### 3.6. STERILIZATION OF DOMESTIC WATER SYSTEMS

After final pressure testing of distribution system thoroughly flush entire system with water until free of dirt and construction debris. Fill system with solution of liquid chlorine or hypochlorite of not less than 50 PPM. Retain treated water in system until test indicates non-spore-forming bacteria have been destroyed or for 24 hours whichever is greater.

All points in systems shall have at least 10 PPM of solution at end of retention period. Open and close each valve at least six times in system during sterilization process to sterilize valve parts.

When time and concentration conditions have been met, drain system and flush with fresh domestic water until residual cleaning solution is less than 1.0 PPM. Open and close each valve in system six times during flushing operation.

Test samples taken from several points in system shall indicate absence of pollution for two full days. Repeat sterilization as required. Acceptance of system will not be given until satisfactory bacteriological results are obtained.

### 3.7. 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.

### 3.8. 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.

### 3.9. 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.

### 3.10. PIPING IDENTIFICATION

Provide pipe markers at 10'-0" maximum spacing to identify piping in mechanical rooms and 20'-0" maximum spacing in all other areas with Seaton setmark pipe markers with letters and flow direction arrows. Colors and wording shall be of standard pipe markers as available from Seaton or equal. Submit for approval list of colors and wording prior to purchase of pipe markers. Pipe markers shall meet applicable ANSI Standard and OSHA requirements.

### 3.11. VALVE IDENTIFICATION

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 ½" high. Tags shall be minimum 2" in diameter and attached to valve with Seton No. 16 brass jack chain.

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.

### 3.12. EXCAVATION AND BACKFILL

Perform necessary excavation to receive Work. Provide necessary sheathing, shoring, cribbing, tarpaulins, etc. for this operation, and remove it at completion of work. Perform excavation in accordance with appropriate section of these specifications, and in compliance with OSHA Safety Standards.

Excavate trenches of sufficient width to allow ample working space, and no deeper than necessary for installation work.

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 pavings in six inch layers to 95% standard density, Reference Division 2.

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.

When available, refer to test hole information on Architectural or Civil drawings or specifications for types of soil to be encountered in excavations.

### 3.13. FIRE BARRIERS

Provide sleeves through all fire-rated walls and fill voids surrounding sleeves and interior to sleeves around piping with Nelson "Flameseal" fire stop putty with U.L. listed 3 hour rating installed as per manufacturers recommendations.

Equivalent by Dow, Chemelex, 3M.

All holes or voids created by the mechanical contractor to extend piping or ductwork through fire rated floors and walls shall be sealed with an intumescent material capable of expanding up to 8 to 10 times when exposed to temperatures of 250 degrees F. It shall have ICBO, BOCAI and SBCCI (NRB 243) approved ratings to 3 hours per ASTM E-814 (UL 1479). Acceptable Material: 3M Fire Barrier Caulk, Putty, Strip and sheet forms.

### 3.14. EQUIPMENT ANCHORS

Provide floor or foundation mounted equipment such as pumps, boilers, air handling units, etc. with Decatur Engineering Company concrete anchors.

Where equipment anchors cannot be installed during forming of floors or foundations anchor equipment with McCulloch Kwik-Bolt concrete anchors.

Anchors shall be proper type and size recommended by manufacturer for equipment to be anchored.

END OF SECTION 15050

**SECTION 15100 - PIPING****1. PART 1 - GENERAL****1.1. RELATED DOCUMENTS**

Reference Section 15010. 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. PIPING MATERIALS**

Piping used throughout project shall conform to the following specifications. Piping shall be plainly marked with manufacturers name and weight. See piping material schedule at end of this Section for materials to be used for each piping system.

**2.1.1. Cast Iron Bell and Spigot Soil Pipe:**

Pipe and fittings shall be gray cast iron bell and spigot ends with lead grooves and spigot end lead beads. Pipe and fittings shall be coated inside and out with asphaltum preservative and meet requirements of current Cast Iron Soil Pipe Institute Standard HS-67 and ASTM Standard A74-69.

Seal joints with lead and oakum in accordance with current ANSI Specification A40.8 or Seal joints with neoprene pipe gaskets meeting current ASTM Standard A564-68.

Pipe and fittings by Tyler Pipe or Charlot.

**2.1.2. Hubless Cast Iron Soil Pipe:**

Pipe and fittings shall be gray cast iron with spigot bead and positioning lug. Pipe and fittings shall be coated inside and out with asphaltum preservative and shall meet requirements of current Cast Iron Pipe Institute Standard 301-69T.

Pipe joints shall be no-hub joint couplings consisting of neoprene rubber sleeve, stainless steel shield and clamp assembly or pipe joints shall be MB coupling consisting of cast iron housing with neoprene gasket and 18-8 stainless steel bolts and nuts.

Pipe and fittings shall be by Tyler Pipe or Charlot.

**2.1.3. Ductile Iron Pipe:**

Pipe: Ductile iron shall be ANSI A21.51, AWWA C151. All pipe joints shall be mechanical unless otherwise indicated. Pipe shall be color coded by blotches of paint. The Contractor shall submit a "color class" schedule of the pipe as marked by the manufacturer.

Inside coating shall be cement-mortar lining with seal coat of bituminous material in accordance with ANSI A21.4.

American Water Works Associations (AWWA) Standards:

C151-86 Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for water, or other liquids.

American National Standards Institute (ANSI):

A21.4-1985 Cement mortar lining for gray-iron and Ductile-Iron Pipe and Fittings for water.

A21.10-1987 Gray-Iron and Ductile-Iron Fittings, 3 inch through 48 inch for water and other liquids.

A21.11-1985 Rubber gasket joints for gray-iron and ductile-iron pressure pipe and fittings.

A21.51-1986 Ductile-iron pipe centrifugally cast in metal molds for sand-lined molds for water or other liquids (AWWA C151-1981).

2.1.4. Carbon Steel Pipe (1/8" thru 2"):

Provide seamless carbon steel conforming to ASTM specification A-106.

Pipe joints shall be threaded conforming to ANSI Standard B2.1.

Pipe by Armco, Jones, Laughlin Steel Corp., Youngstown Sheet and Tube Co., or United States Steel.

2.1.5. Carbon Steel Pipe (2-1/2" and above):

Provide electric resistance welded carbon steel pipe conforming to ASTM Specification A-53.

Pipe ends shall be beveled for welding.

Pipe by Armco, Jones and Laughlin Steel Corp., Youngstown Sheet and Tube Co., or United States Steel.

2.1.6. Copper Tube:

Provide hard temper copper water tube conforming to requirements of current ASTM Specification B-88. Tubing shall be Type K, L, or M as listed in schedule. Tubing joints shall be soldered or brazed. See schedule for joining method to be used.

Pipe by Anaconda, Cerro, Chase, Mueller or Revere Copper.

2.1.7. Copper Tube Type ACR:

Provide hard temper nitrogenized copper refrigerant tube conforming to requirements of current ASTM B-88. Tubes shall be Type L or K as listed in schedule.

Tubing joints shall be brazed.

Pipe by Anaconda, Cerro, or Mueller.

2.1.8. Below Grade Pre-Insulated Chilled Water Piping:

Provide Wirsbo Ecoflex Thermo Single cross-linked polyethylene piping for below grade chilled water piping from the building to the chiller. Provide a PVC pipe long sweep pipe sleeve at the chiller cast into the chiller pad for this piping. Above grade convert to copper piping. Equivalents: Perma-Pipe poly-therm PVC, Thermal Pipe Systems, Inc. Kool-Kore PVC or equal. Polyethylene Pipe:

Provide polyethylene pipe for gas service conforming to ASTM D-1248. Pipe shall be UV stabilized. SDR of 11.

Pipe by Driscopipe or equal.

2.1.9. Polyvinyl Chloride Drain Waste Pipe:

Provide Schedule 40 polyvinyl chloride plastic drain waste and vent pipe conforming to ASTM D2665-88. Joints shall be properly cleaned, primed and glued.

Pipe by Charlot, Genova, Crestline or equal.

2.1.10. Polypropylene Chemical Waste and Vent Pipe:

Provide Schedule 40 polypropylene pipe conforming to current ASTM D635 and D2447-74.

Pipe by Lab/Line-Enfield Industrial Corp. or Orion equal.

## 2.2. PIPING FITTINGS

Piping fitting used throughout project shall be proper type for installation method used and shall be compatible with piping system material. Fittings listed in piping material schedule shall conform to the following specifications:

### 2.2.1. Carbon Steel Welding Fittings:

Provide carbon low alloy seamless steel welding fittings conforming to current ANSI Standard B16.9 and ASTM Specification A234.

Fittings by Grinnell, Midwest or Tube Turn.

### 2.2.2. Branch Connection Welding Fittings:

Provide carbon steel weldolet fittings conforming to ANSI Standards B16.9, B16.11, B31.1.0 and ASTM specification A105, Grade 11.

Fittings by Bonney Forge.

### 2.2.3. Branch Connection, Welding to Screwed Fitting:

Provide carbon steel threadolet fitting conforming to ANSI Standards B16.9, B16.11, B31.1, and ASTM Specification A105, Grade 11.

Fittings by Bonney Forge.

### 2.2.4. Carbon Steel Flanges:

Provide carbon steel flanges conforming to ASTM Specification A181, Grade 1, and ANSI Standard B16.5.

Flanges by Babcock and Wilcox, Grinnell, Midwest or Tube Turn.

### 2.2.5. Malleable Iron Screwed Fittings:

Provide screwed malleable iron fittings conforming to ANSI Standard B16.3, and ASTM Specification A-47 grade 32510.

Fittings by Crane, Grinnell or Stockham.

### 2.2.6. Cast Iron Screwed Fittings:

Provide screwed cast iron fittings conforming to ANSI Standard B16.4, B2.1, and ASTM Specification A-126, Class A.

Fittings by Crane, Grinnell or Stockham.

### 2.2.7. Wrought Copper Fittings:

Provide wrought solder joint copper tube fitting conforming to ANSI Standard B16.22

Fittings by Anaconda, Chase or Nibco.

### 2.2.8. Cast Bronze Fittings:

Provide cast bronze solder joint fittings conforming to ANSI Standard B16.18.

Fittings by Anaconda, Chase or Nibco.

### 2.2.9. Pipe Flange Gaskets:

Provide 1/16" thick asbestos free gaskets full face or ring type as required. Gaskets shall be factory cut.

Gaskets by Durable Mfg. Co. or Garlock Company.

2.2.10. Roll Grooved Pipe Couplings:

Provide Victaulic style #07 or approved equal style (zero flex) couplings with Grade “E” gasket (EPDM compound) in mechanical areas. Provide Victaulic style #77 or approved equal style (flexible) couplings with Grade “E” gasket in other areas. Provide with ductile iron housing and nuts and bolts.

Equivalent by Grinnell.

2.2.11. Polypropylene Joints:

Above grade joints shall be mechanical joints conforming to current ASTM Specification C-425. Below grade joints shall be fusion weld connections.

2.2.12. Ductile Iron Pipe Joints and Fittings:

Joints: Ductile iron shall be mechanical joints of the latest approved design of the manufacturer. Joints shall be so designed to guarantee a water-tight joint for the life of the pipeline.

Fittings: Ductile iron shall be short body mechanical as shown on the drawings, or required of the same pressure design as the pipe. Dimensional control and joint design shall conform to ANSI Standard A21.10 and A21.11. All fittings shall be coated as specified for the pipe. Where rods or ties are shown or called for, fittings shall be provided with anchoring lugs.

Joint Materials: Ductile Iron Joint: Mechanical joints, bolts, glands, retainer glands and gaskets, ANSI Standard A21.11.

2.2.13. PVC Fittings:

PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe. PVC Non-pressure Piping Joints: Join piping according to ASTM D 2665.

Equivalents: Spears, Lasco or equal.

2.3. PIPING AND EQUIPMENT INSULATION

Provide necessary materials and accessories for installation of insulation for plumbing and mechanical systems as specified and/or detailed on drawings insulation type, jacket, and thickness for specific piping systems or equipment shall be as listed in insulation schedule. Provide insulation materials manufactured by Armstrong Industries, Dow Chemical, Schuller, Knauf Fiberglass or Owens-Corning Fiberglas.

Insulation, except where specified otherwise, shall have composite fire and smoke hazard ratings as rested by ASTM E-84, NFPA 255, and UL 723 procedures not exceeding:

FLAME SPREAD	25
SMOKE DEVELOPED	50
FUEL CONTRIBUTED	50

Provide insulation accessories such as adhesives, mastics, cements, tape and glass fabric with same component ratings as listed above. Products or their shipping cartons shall bear label indicating their flame and smoke safety shall be permanent. Use of water soluble treatments such as corn paste or wheat paste is prohibited. This does not exclude approved lagging adhesives.

Install insulation over clean dry surfaces with joints firmly butted together. Insulation at equipment, flanges, fittings, etc. shall have straight edges with box type joints with corner beads as required. Where plumbing and heating insulation terminates at equipment or unions, taper insulation at 30 degree angle to pipe with one coat finishing cement and finish same as fittings. Total insulation



system shall have neat smooth appearance with no wrinkles, or folds in jackets, joint strips or fitting covers.

Undamaged insulation systems on cold surface piping and equipment shall perform their intended functions as vapor barriers and thermal insulation without premature deterioration of insulation or vapor barrier. Contractor shall take every reasonable precaution to provide insulation systems with continuous unbroken vapor barriers.

Where glass fabric is specified in the following insulation methods provide resin impregnated white open weave glass fabric with 10/20 thread count. Provide glass cloth similar to Alpha Martex wettable glass cloth.

Abbreviations for manufacturers of adhesive, mastics and coating specified shall be C.M. for Chicago Mastic Company and B.F. for Benjamin Foster Company.

Insulation of removable heads, manholes access covers, etc., shall be fabricated to allow removal without damage to insulation. Provide removable units with vapor-proof cover fabricated to be sealed to equipment vapor barrier.

Insulation failing to meet workmanship and appearance standards shall be replaced with an acceptable installation before final acceptance of project will be given. Insulation failing to meet performance requirements of this specification for a period of one year after date of final acceptance or through one heating season and one cooling season, whichever is longer shall be replaced with an acceptable installation. All costs to correct insulation deficiencies and costs to repair damages to other work shall be at Mechanical Contractors expense at no cost to owner.

#### 2.4. INSULATION MATERIALS AND APPLICATION METHODS (PIPING)

Pipe insulation by type shall be as follows:

##### 2.4.1. TYPE 1

Insulation for hot and cold surface piping systems with -20 degrees F to +850 degrees F operating range shall be by Owens-Corning Fiberglass, Schuller, or Knauf ASJ/SSL-11, 4.2 lb. density pipe insulation with white fire retardant ASJ jacket and self-sealing lap. Average thermal conductivity shall not exceed .26 BTU/Hr. at 75 degrees F mean temperature. Seal longitudinal jacket laps and butt strips with C.M. No. 17-465 or B.F. No. 85-75 vapor barrier adhesive. Insulate valves and fittings as follows:

Insulate exposed and concealed valves and fittings with 2" thick glass fiberglass inserts or blankets. Cover fittings with Zeston Products PVC fitting covers or approved equal. PVC fitting covers shall be secured with mechanical fasteners such as tacks or staples for temperatures above 75 degrees F. For cold service all joints shall be sealed with vapor barrier adhesive or by pressure sensitive vapor barrier vinyl tape.

#### 2.5. INSULATION MATERIALS AND APPLICATION METHODS (EQUIPMENT)

Equipment insulation materials and application methods shall be as follows:

##### 2.5.1. TYPE 2

Insulation for cold surface equipment insulation shall be by Owens-Corning Fiberglass, Schuller, or Knauf for external surfaces with +40 degrees F to +220 degrees F operating temperature range shall be pipe or sheet insulation as required with 5.5 or 6.0 lb. density. Average thermal conductivity shall not exceed .27 BTU/HR at 75 F mean temperature. Apply insulation directly to metal surfaces and seal insulation joints. Insulation shall be mitered, beveled and built-up as required to provide a smooth and neat exterior surface. On large pumps and equipment provide joints in insulation at points where equipment casing must be disassembled for maintenance and

repair. Insulate these joint areas so that insulation can be easily removed from casing joints without removing or damaging adjacent insulation. Finish insulation with two coats of vinyl-lacquer finish.

**2.6. INSULATION MATERIALS AND APPLICATIONS METHODS (HANGERS, SUPPORTS, ANCHORS, GUIDES, EXPANSION JOINTS, ETC.)**

Insulation materials and application methods for piping hangers supports, anchors, guides expansion joints, etc., shall be as follows:

Insulate hangers and supports from direct contact with cold or hot surfaces (-120°F to 450°F) with “Buckaroos Inc.” or approved equal pipe insulation support system.

The length of the “Buckaroo” insulation support same as the pipe insulation thickness. Provide ASJ type discs to reestablish vapor barrier.

**2.7. INSULATION SCHEDULE**

<b>INSULATION SERVICE</b>	<b>SIZE</b>	<b>TYPE</b>	<b>THICKNESS</b>	<b>JACKET</b>
Condensate Drain	All Sizes	1	1/2”	ASJ
*Refrigerant Suction	All Sizes	1	1”	ASJ

\*Provide a minimum of .016” thick aluminum jacket with band clamps and aluminum fitting covers over all pipe insulation located on the exterior of the building.

**3. PART 3 - EXECUTION**

**3.1. PIPING INSTALLATION**

Piping systems materials and installation shall conform to the following standards and codes.

- System: Heating and Air Conditioning Piping
- Code: ANSI Standard B31.1.0 “Power Piping”
- System: Natural Gas Piping
- Code: ANSI Standard B31.12 “Fuel Gas Piping”
- System: Plumbing System Piping
- Code: International Association of Plumbing & Mechanical Official’s “Uniform Plumbing Code”

No piping containing water shall be located in areas subject to freezing temperatures, including: unheated attics, unheated plenums, chases wall spaces or cavities within exterior walls, under slabs, or in concrete.

Pipe sizes indicated on plans and as specified refer to nominal size in inches, unless otherwise indicated. Pipes are sized to nearest 1/2”. In no case shall piping smaller than size specified be used.

Contractor shall provide and be responsible for proper location of pipe sleeves, hangers, supports, and inserts. Install hangers, supports, inserts, etc., as recommended by manufacturer and as specified and detailed on drawings.

Verify construction types and provide proper hangers, inserts and supports for construction used. Install inserts, hangers and supports in accordance with manufacturers load ratings and provide for thermal expansion of piping without exceeding allowable stress on piping or supports. Provide

solid type hangers and supports where pipe travel exceeds manufacturer's recommendations for fixed hanger and supports.

Install piping parallel with building lines and parallel with other piping to obtain a neat and orderly appearance of piping system. Secure piping with approved anchors and provide guides where required to insure proper direction of piping expansion. Piping shall be installed so that allowable stress for piping, valves and fittings used are not exceeded during normal operation or testing of piping system.

Install piping so that systems can be completely drained. Provide piping systems with valve drain connections at all low pipe and ahead of all sectionalizing valves whether shown on plans or not. Drain lines shall be  $\frac{3}{4}$ ".

Drain valves on closed piping systems such as chilled water system shall have lock shields and plugged or capped outlets to protect system from inadvertent drainage.

Pitch all piping and where possible make connections from horizontal piping so that air can be properly vented from system. Provide air vents as specified at all system high points and at drop in piping in direction of flow. Use eccentric reducers where necessary to avoid air pockets in horizontal piping.

Provide unions or flanged joints in each pipe line preceding connections to equipment to allow removal for repair or replacement. Provide all screwed and control valves with unions adjacent to each piping connection. Provide screwed end valves with union adjacent to valve unless valve can be otherwise easily removed from line.

Fittings pressures and temperature ratings shall be equal to or exceed maximum operating temperature and working pressure of piping system. No mitered or field fabricated pipe fittings will be permitted.

All pipe threads shall meet ANSI Standard B2.1 for taper pipe threads. Lubricate pipe threads with Teflon thread sealant and lubricating compound applied full strength. Powdered or made-up compound will not be permitted. Pipe thread compound shall be applied only to male pipe threads.

Brazed socket type joints shall be made with suitable brazing alloys. Minimum socket depth shall be sufficient for intended service. Brazing alloy shall be end fed into socket, and shall fill completely annular clearance between socket and pipe or tube. Brazed joints depending solely upon a fillet rather than a socket type joint will not be acceptable.

Soft soldered socket type joints shall be made with sill-floss or 95-5 tin-antimony solder as required by temperature and pressure rating of piping system. Soldered socket-type joints shall be limited to systems containing non-flammable and non-toxic fluids. Soldered socket-type joints shall not be used on piping systems subject to shock vibration. Soldered joints depending solely upon a fillet rather than a socket-type joint will not be acceptable.

Make changes in piping size and direction with approved factory made fittings. Provide fittings suitable for at least 125 PSI working pressure or of pressure rating required for maximum working pressure of system whichever is greater.

### 3.2. PIPING SUPPORTS, ANCHORS, SLEEVES AND SEALS

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.

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.

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.

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.

Pipe insulation shall run continuous through pipe sleeves with  $\frac{1}{4}$ " 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  $\frac{3}{8}$ " wide band. Seal annular space between jacket and pipe sleeves with Thunderline High Temperature Link Seal.

Pipe wall penetrations exposed to view shall have tight fitting escutcheons or flanges to cover all voids around openings.

All below grade and exterior wall penetrations shall be installed in a pipe sleeve and sealed between the pipe and pipe sleeve with Thunderline High Temperature Link Seal.

Provide sleeves through all fire-rated walls and fill voids surrounding sleeves and interior to sleeves around cables with Nelson "Flameseal" fire stop putty with U.L. listed 3 hour rating installed as per manufacturers recommendations.

Equivalent by Dow, Chemelex, 3M.

### 3.3. PIPE HANGERS AND SUPPORTS

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.

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.

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.

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.

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

PIPE SIZE	ROD DIAMETER	MAXIMUM SPACING
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.

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

NOM. TUBING SIZE	ROD DIAMETER	MAXIMUM SPACING
Up to 1"	3/8"	6 Ft.
1-1/4" to 1-1/2"	3/8"	8 Ft.
2"	3/8"	9 Ft.

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

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

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.

Provide Grinnell pipe hangers for vertical pipe risers as follows:

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

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

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.

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.

Provide Grinnell pipe hangers for horizontal single pipe runs as follows:

PIPE MATERIALS	PIPE SIZE	HANGER FIG. NO.
Copper	1/2" thru 4"	CT-65
Steel	3/8" thru 4"	65
Steel	5" thru 30"	260

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

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

\*Copper Plated

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.

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.

Provide Elcen Fig. 50 pipe saddle with adjuster to support piping from floor. Provide complete with pedestal type floor stand.

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.

Equivalent hangers and supports by Auto-Grip, Basic Engineer, Bee Line, Elcen, Fee & Mason, Fluorocarbon Company, Unistrut or Super Strut Inc.

Provide polycarbonate pipe support for piping located on flat roofs, unless otherwise indicated on drawings. Support will be of modular stackable design with a nylon roller bearing directly supporting pipe and a preformed saddle to keep piping on roller bearing. Maximum pipe support spacing shall be 10'. Provide pipe supports from Miro Industries, or approved equivalent, in the following sizes:

PIPE SIZE	MODEL NUMBER
Up to 2"	02
2 1/2" thru 4"	24R

See attached piping schedule

END OF SECTION 15100

PIPING MATERIAL SCHEDULE												
PIPING							FITTINGS		MAXIMUM WORKING	NORMAL	FIELD TEST	
SYSTEM	SIZE	TYPE	SCHED.	GRADE	ASTM	MATERIAL	MATERIAL	TYPE	PRESS.	TEMP.	PRESSURE	TIME
Drain Line	All	M	--	--	B-88	CP	CP	SJ	0	40 to 80	--	--
Natural Gas	2-1/2 & Up	ERW	40	--	A-53	CS	CS	W	5	55 to 85	75 lb.	1 hr.
Natural Gas	1/2"-2"	SL	40	--	A-106	CS	MI	T	5	55 to 85	75 lb.	1/2 hr.
Natural Gas Below Grade	All	PE	SDR- 11	--	D-1248	PE	PE	F	30	60	100	1 hr.
Refrigerant Lines	All	ACR			B-88	CP	CP	SS	225	30 to 125		See Div. 15

ABBREVIATIONS:

- |                    |                               |                              |                                 |                     |
|--------------------|-------------------------------|------------------------------|---------------------------------|---------------------|
| BLK - Black        | ERW - Electric Resistant Weld | MJ - Mechanical Joint        | PE - Polyethylene               | SS - Silver Solder  |
| BS - Bell & Spigot | F - Fusion Weld               | NG - Neoprene Gasket         | PP - Polypropylene              | SV - Service Weight |
| CI - Cast Iron     | GLV - Galvanized              | NH - No Hub                  | S - Socket Joint                | SW - Solvent Weld   |
| CP - Copper        | MECH - Mechanical             | PVC - Polyvinyl Chloride     | SJ - Solder Joint 95-5 antimony | Tin- T - Threaded   |
| CS - Carbon Steel  | MI - Malleable Iron           | PC - Rolled Grooved Coupling | SL - Seamless                   | W - Welded          |
| DI - Ductile Iron  |                               |                              |                                 | V - Victaulic       |

**SECTION 15120 - PIPING SPECIALTIES****1. PART 1 - GENERAL****1.1. RELATED DOCUMENTS**

Reference Section 15010. 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. INSULATING UNIONS AND FLANGES**

Provide insulating unions and flanges conforming to following specifications and plainly and permanently marked with manufacturers name and pressure class rating. Unions and flanges shall be as follows:

**2.1.1. Steel pipe to steel pipe screwed end:**

Provide Stockham malleable iron No. 693-1/2 insulating union with high dielectric strength insulating sleeve and gasket.

**2.1.2. Steel pipe to steel pipe flanged end:**

Provide two weld neck flanges of proper pressure rating insulated on both sides with Central or Klingerit Flange Insulation Kit.

**2.1.3. Iron or steel pipe to copper pipe:**

Provide Epcu Dielectric union or flange with screwed or solder joint as required. Union shall have 250 PSI rating and flange 175 PSI rating at 190 degrees F.

**2.2. UNIONS**

Provide unions or flanged joint in each line preceding connections to equipment or valves requiring maintenance.

Provide Stockham brass seat unions of material and pressure rating required by piping system.

Where piping systems of dissimilar materials are jointed together provide proper insulating union as specified under this specification.

Equivalent unions by Fairbanks or Grinnell.

**3. PART 3 - EXECUTION****3.1. WELDING**

Contractor shall be responsible for quality of welding and suitability of welding procedures. All welding shall be in accordance with American Welding Society Standard B3.0 and ANSI Standard B31.1.

Welded pipe joints shall be made by certified welding procedures and welders. Welding electrodes shall be type and material recommended by electrode manufacturer for materials to be welded. All pipe and fittings ends shall be beveled a minimum of 30 degrees prior to welding.

Only welders who have successfully passed welder qualifications tests in previous 12 months for type of welding required shall do welding. Each welder shall identify his work with a code marking before starting any welded pipe fabrication. Contractor shall submit three copies of a list of welders who will work on project listing welders' code, date and types of latest qualification test passed by each welder.



Welded joints shall be fusion welded in accordance with Level AR3 of American Welding Society Standard AWS D10.9 "Standard for Qualification of Welding Procedures and Welders for Pipe and Tubing". Welders qualified under National Certified Pipe Welding Bureau will be acceptable.

Bevel all piping and fittings in accordance with recognized standards by flame cutting or mechanical means. Align and position parts so that branches and fittings are set true. Make changes in direction of piping systems with factory made welding fittings. Make branch connections with welding tees or forged weldolets.

END OF SECTION 15120

**SECTION 15140 - VALVES**

**1. PART 1 - GENERAL**

**1.1. RELATED DOCUMENTS**

Reference Section 15010. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2. EQUIVALENTS**

Equivalent valves shall be used only from the following specified valve manufacturers and listed on current comparison charts by Apollo, Hammond, Hays, Milwaukee, Muessco, Nibco, Rockwell-Nordstrom, Stockham, and Watts.

**2. PART 2 – PRODUCTS**

**2.1. VALVES**

**2.1.1. BALL VALVES**

Ball valves shall be scheduled as type “BLV” valves. Valve specifications by type number shall be as follows:

Provide ball handle with extension or offset as required to clear piping insulation.

BLV-1: 2-1/2” valves and smaller, Hammond #8501 (screwed) or 8511 (solder) series bronze two piece large port ball valve 600 PSI-WOG/150 PSI-WSP reinforced TFE seats, chrome plate brass ball (tunnel or drilled design), silicon bronze stem vinyl-covered steel lever handle. Stainless steel ball and stem shall be provided for steam applications.

**2.1.2. PLUG VALVES**

Plug valves shall be scheduled as type “PLV” valves. Valve specifications by type number shall be as follows:

PLV-1: 1” valves and smaller Hays 7400 series iron body gas cock, 175 PSI-WOG bronze plug washer and nut, screwed ends.

PLV-2: 1-1/4” through 4” valves, Rockwell-Nordstrom Fig. 142, semi-steel lubricated plug valve, 175 PSI-WOG coated plug, two bolt cover, and short pattern screwed ends. Provide complete with standard pattern cast handle.

**2.2. VALVE SCHEDULE**

SYSTEM	SIZE	STOP	CHECK	BALANCE
Domestic Water	1/2”-2-1/2”	BLV-1	SCV-1	--
Natural Gas	1/2” - 1”	PLV-1	--	--
Natural Gas	1-1/4”-4”	PLV-2	--	--

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

#### **3.1. INSTALLATION**

Install necessary valves within piping systems to provide required flow control, to allow isolation for inspection, maintenance and repair of each piece of equipment or fixture, and on each main and branch service loop.

Each valve shall be installed so that it is easily accessible for operation, visual inspection, and maintenance and wherever possible, gate, check and ball valves shall be installed on a horizontal run with the handle upright and within 15 degrees of vertical. Butterfly valves shall be installed with the stem in the horizontal position and the handle at 90 degrees from vertical.

Valves installed in piping systems shall be compatible with system maximum test pressure, pipe materials, pipe joining method, and fluid or gas conveyed in system.

Valves 2-1/2" and smaller shall have soldered or screwed end connections as required by piping materials unless otherwise specified or shown on drawings. Install union connection in the line within two feet of each screw end valve unless valve can be otherwise easily removed from line. Valves 3" and over shall have flange end connections.

Non-rising stem valves shall not be installed at any point in the piping systems. With permission of Architect-Engineer non-rising stem valve may be installed at particular points where space is restricted.

Provide butterfly valves 6" and smaller with 10 position lever handle for on-off application and infinite position handle for throttling applications. Provide butterfly valves 8" and up with fully enclosed all weather gear operators.

Install globe valves with pressure on top of disc except that must be completely drained for inspection, maintenance or to prevent freezing shall be installed with stem in horizontal position to insure complete drainage of pipelines.

Gate valves shall not be installed in pipelines where intended for throttling service or where piping is subject to vibration as part of normal operating conditions.

Valves shall be designed for repacking under pressure when fully opened and backseated.

Balancing valves installed by means of sweating or soldering shall have their interiors removed before installation and reinstalled upon dissipation of the heat associated with installation. Using a wet rag in lieu of removing the valve interior as a means of heat dissipation during installation is not acceptable.

END OF SECTION 15140

**SECTION 15200 - SHEET METAL****1. PART 1 - GENERAL****1.1. RELATED DOCUMENTS**

Reference Section 15010. 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. DUCTWORK**

Construct ductwork as detailed on drawings and as detailed in the 1995 edition of the Sheet Metal and Air Conditioning Contractor's Association (SMACNA) HVAC Duct Construction Standards for Metal and Flexible Ducts. 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 the SMACNA Manual.

**2.1.1. PRESSURE CLASSIFICATIONS**

Construct ductwork in accordance with operating static pressure range. Ductwork pressure classifications shall be as follows:

**2.1.1.1. Low Pressure Ductwork (Class C):**

System operating static pressure 2" positive or negative of W.G. or less.

Construct low pressure system ductwork to conform to latest edition duct construction standards of SMACNA Duct Construction Standards Manual for Class C sealing.

All ductwork downstream of VAV terminal units and associated with remaining low pressure air handling units shall be constructed according to the low pressure classification.

**2.1.1.2. Medium Pressure Ductwork (Class B):**

System operating static pressure 3" positive or negative of W.G. or less.

Construct medium pressure system ductwork to conform to latest edition duct construction standards of SMACNA Duct Construction Standards Manual for Class B sealing.

**2.1.1.3. High Pressure Ductwork (Class A):**

System operating static pressure 4" positive or negative of W.G. and greater.

Construct high pressure system ductwork to conform to latest edition duct construction standards of SMACNA Duct Construction Standards Manual for Class A sealing.

All ductwork upstream of VAV terminal units shall be constructed according to the high pressure classification.

**2.2. DUCTWORK MATERIALS****2.2.1. RECTANGULAR OR ROUND STEEL**

Provide new commercial quality, bright spangled galvanized sheet steel manufactured in the USA

**2.3. SHEET METAL SPECIALTIES AND DUCTWORK ACCESSORIES**

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:

### 2.3.1. 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.

### 2.3.2. 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.

### 2.3.3. Manual Balancing 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, Cesco, United Air, NCA.

### 2.3.4. Backdraft Dampers

Unless backdraft dampers are specified with a particular piece of equipment, provide Cesco #BDA-101-H with 16 gauge heavy duty aluminum blade construction, counter balanced and connected with tie bar to assist air flow complete with end seals and blade seals, with oiled bearings mounted in steel frame. Equivalent by Ruskin, Greenheck, Air Balance, Air Stream, Titus, NCA.

### 2.3.5. 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.

### 2.3.6. Access Doors

Provide access doors in ductwork, ceilings, 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, and cam action type. Doors and frames shall be furnished in prime coat of Higgins, Milcor, Donley or equal.

### 2.3.7. 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.

### 2.3.8. Round take-off fittings(low pressure)

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.

### 2.3.9. Low Pressure Flexible Duct

Thermaflex M-KE 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 bi-directional reinforced metallized outer vapor barrier. Maximum

flexible duct length or run shall be 5'-0" unless otherwise noted. Flexible ductwork shall be securely attached to both the rigid duct connection and diffuser neck with plastic band clamps or stainless steel worm driven clamps. Equivalent by Wiremold, Cleavaflex, Flexmaster.

2.4. DUCTWORK INSULATION

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.

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

Insulation shall meet ASTM C411 performance test and shall be installed in conformance with NFPA Standard 90A.

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:

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.

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.

Eliminate ductwork insulation on exposed round ductwork unless noted otherwise in ductwork insulation schedule.

Duct insulation materials by type shall be as follows:

2.4.1. Type 1-DIL (Duct interior liner)

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.

2.4.2. Type 2-DEW (Duct exterior wrap)

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.

2.4.3. Type 3-DEW (Duct exterior wrap)

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 by Thermaflex, Flexmaster, Cleavaflex, or Wiremold.

2.4.4. Type 4-DEW (duct exterior wrap)

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 recommendations. Equivalent by 3M ductwrap, provide (2) 1 ½” layers.

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

2.5. DUCT INSULATION SCHEDULE

DUCTWORK SYSTEM	TYPE	THICKNESS
Rectangular Supply & Return	1-DIL	½”
Rectangular Outside Air	1-DIL	1”
Rectangular Exhaust	1-DIL	½”
Round Exhaust	2-DEW	1-1/2”

Omit internal insulation on exhaust ductwork from kitchen hoods.

2.6. GRILLES, REGISTERS AND DIFFUSERS

Provide units by Carnes, Trane, Barber-Coleman, Titus, E.H. Price, Tuttle & Bailey, Nailor Industries, Krueger

Provide where shown on plans grilles, registers, and diffusers. Set all units with rubber gaskets for air tight connection with mounting surface, see drawings for types, sizes, air flow and quantity. Refer to schedule on plans.

Install all registers with curve of louver away from line of sight. Unless noted otherwise, provide duct mounted diffusers and registers with standard margins. Finish shall be off white when mounted in ceiling, prime coat when mounted on wall finish.

Provide proper mounting supplies and arrangements for areas shown. Check Architectural drawings for ceiling and all construction.

2.7. BREECHINGS, FLUES AND STACKS

2.7.1. BOILER WATER HEATER AND DOMESTIC WATER HEATER FLUE

Furnish and install where shown on plans as type “B” double wall gas venting system complete with pipes and fittings, roof support assemblies, wall support assemblies and stack cap. Connect chimney system to boiler as shown on plans. Provide all necessary hangers and supports to support entire length of chimney. Submit complete details for approval prior to installation including weights connection details, dimensions, accessories, approvals and installation instructions.

Type “B” double wall gas venting system as defined by the Uniform Mechanical Code, a factory-made gas vent listed by a nationally recognized testing agency for venting listed or approved appliances equipped to burn only gas.

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

#### **3.1. DUCTWORK INSTALLATION**

All ductwork shall be installed in strict accordance with SMACNA "HVAC Duct Construction Standards" First Edition 1985. All ductwork accessories shall be installed in strict accordance with manufacturer's requirements SMACNA, NFPA 90A and 90B, UL listings and drawing details. Grilles, registers and diffusers shall be installed in accordance with SMACNA requirements, where balancing dampers are not provided in duct work preceding diffusers, provide opposed blade balancing damper in neck of diffuser.

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.

#### **3.2. DUCT CONSTRUCTION**

All metal ductwork scheduled for interior thermal and acoustical liner is not sized on plans to include the proper thickness of insulation. Add 1" or 2" in height and width of ductwork as required to accommodate insulation thickness. Mount specialties such as turning vanes, dampers, etc., to ductwork with that section insulated "Build Outs" to maintain continuity of thermal barrier.

Provide spiral wound duct on all round ductwork greater than 10" diameter.

Provide longitudinal seam duct on all round ductwork 10" diameter or less.

#### **3.3. DUCTWORK SEALING**

Sealing of ductwork shall be as follows:

##### **3.3.1. Option #1**

Ductwork: Including supply, return and exhaust. Provide Hard Cast, Inc. mineral impregnated woven fiber tape and activator/adhesive in accordance with manufacturers' directions on all joints, connectors, etc.

##### **3.3.2. Option #2**

Rectangular ductwork: Provide "Ductmate" systems as manufactured by Ductmate Industries, Inc. or an approved equal system.

##### **3.3.3. Option #3**

Ductwork: Including supply, return and exhaust. Provide Hard Cast, Inc. "Foil Grip" pressure sensitive duct joint sealer. Seal class "A", "B", and "C".

##### **3.3.4. Option #4**

Ductwork: Including supply, return and exhaust. Provide liquid or mastic sealant specifically designed and tested for duct sealing. Apply in accordance with manufacturers' directions on all joints, connectors, etc. This option is acceptable for low pressure Class "C" ductwork only.

#### **3.4. BREECHING AND FLUE INSTALLATION**

Install venting in accordance with manufacturer's recommendations, SMACNA recommendations, and as indicated on drawings.

Support vent to resist 100 MPH wind velocities.

Ensure that vent is properly aligned. Connect sections as recommended by manufacturer and provide recommended expansion joints.



Maintain minimum clearances required by UL and NFPA.

Provide insulated thimble and flashing as indicated on plans.

Extend vent to a minimum of 3'-0" above roof unless indicated otherwise on plans.

#### 3.4.1. ADJUSTING AND CLEANING

Clean breechings internally during installation, removing dust and debris.

Clean external surfaces of foreign substances that might cause corrosive deterioration of metal.

At ends of breeching not connected to equipment or stacks at time of installation, provide temporary closure of galvanized sheet metal or other covering until time connections are complete.

END OF SECTION 15200

**SECTION 15400 - PLUMBING****1. PART 1 - GENERAL****1.1. RELATED DOCUMENTS**

Reference Section 15010. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2. ELECTRICAL WORK REQUIRED**

Contractor shall provide electrical connections for any equipment that requires electrical connections for power or control. Electrical requirements and work shall be coordinated with Electrical Contractor.

**1.3. PIPING SYSTEMS**

Refer to Section 15100 of this specification for piping material specifications and installation instructions. Specific piping materials and joining methods for systems installed under this section shall be as listed in schedule.

**1.4. PIPING SYSTEMS VALVES**

Refer to Section 15140 of this specification for valve type specifications and installation instructions.

**1.5. PIPING SYSTEMS INSULATION**

Refer to Section 15100 for insulation type specifications and installation instructions.

**2. PART 2 – PRODUCTS****2.1. PLUMBING FIXTURES**

Provide plumbing fixtures as shown on drawings and as specified complete including piping and connections. China fixtures shall be of best grade vitreous ware without pit holes or blemishes and outlines shall be generally true. Architect-Engineer reserves right to reject any piece, which in their opinion is faulty. Fixtures fitting against walls shall have ground backs. Exposed piping and fittings shall be chrome plated.

All wall mounted urinals and lavatories shall be furnished with concealed arm carriers. All wall-mounted water closets shall be furnished with concealed carriers.

Set fixtures true and level with all necessary supports for fixtures installed before wall finish is done. Nipples through wall to fixture connections shall be chrome plated brass. Provide silicone sealer around perimeter of lavatories, water closets, and urinals at connection to wall and/or floor.

**3. PART 3 - EXECUTION**

All plumbing fixtures shall be cleaned and free of all construction debris. Electric water cooler shall be protected during construction. Any chrome trim with wrench marks shall be removed and new trim installed. Architect-Engineer reserves the right to reject any plumbing fixture.

See plans for Plumbing Fixture Schedule.

END OF SECTION 15400

**SECTION 15600 - HVAC AIR SIDE EQUIPMENT****1. PART 1 - GENERAL****1.1. RELATED DOCUMENTS**

Reference Section 15010. 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. FURNACES, EVAPORATORS & CONDENSING UNITS**

Owner will pre-purchase these items, contractor to receive and install.

Equivalents by Luxaire, Oxbox, or owner approved alternative only.

**2.1.1. HIGH EFFICIENCY CONDENSING FURNACES**

Provide 90% efficient upflow, natural gas heating furnace certified by American Gas Association. Electronic spark ignition, dual solenoid combination gas valve and regulator, aluminized steel heat exchanger, single port non-linting burners, auto temperature on-temperature off adjustable fan unit control, multi-speed direct drive, blower motor, blower door safety switch to terminate furnace operation when blower door is removed, heavy gauge steel cabinet construction with baked-on enamel finish insulated with foil faced fiberglass insulation. Provide 2" or 3" plastic C/A and flue piping complete with concentric roof termination kits. Insulate flue piping.

Provide Farr 20/20 or equal pleated disposable air filters in sizes as specified. Mount filter in slide rack with hinged door and latch in return duct work.

**2.1.2. FAN ASSISTED COMBUSTION FURNACES**

Provide natural gas heating furnaces certified by American Gas Association. Electronic spark ignition, combination gas valve and regulator, aluminized steel heat exchanger, aluminized steel burner, fan and limit controller with stainless steel port protectors, inducer blower heavy gauge steel cabinet construction with baked-on enamel finish. Direct drive multi-speed blower motor. Rated efficiency shall not be less than 80%.

Gas flue shall be Type "B" sized and installed in accordance with manufacturers recommendations.

**2.1.3. DIRECT EXPANSION EVAPORATOR COILS**

Provide blow-thru coil module consisting of fully insulated metal casing with drain pan and duct flanges. Coil shall have copper tubes with aluminum fins. Provide thermostatic expansion valve.

**2.1.4. CONDENSING UNITS**

Provide condensing unit with heavy gauge integral steel base, hermetic compressor, condenser coil, and motor. Rated SEER shall not be less than 13. Refrigerant shall be R-410a. Provide one year parts and labor warranty on the entire system and an additional 4 year compressor only warranty.

Mount units on concrete pads.

Unit frame shall be one-piece welded of 18-gauge zinc coated galvanized steel, baked-on enamel finish.

Compressor shall be hermetic, reciprocating with centrifugal oil pump two-point lubrication for each bearing and connecting rod, crankcase heater and well ring type suction and discharge valves rubber-in-shear isolators. Unit shall have anti-short cycle prevention controls.

Motor shall be suction gas-cooled, internal motor overloads.

Condenser fan shall be vertical discharge with direct drive motor, statically and dynamically balanced, aluminum blades, zinc ball bearings, built-in motor overloads.

Coil shall be aluminum fin mechanically bonded to seamless copper tubing. Factory leak tested at 425 psig.

Provide louvered coil hail guards to alleviate coil damage.

Provide low ambient accessories to allow operation to 0 degrees F. and defrost controls

Manufacturer to final size all refrigerant suction and liquid lines. Provide all accumulators, solenoid valve and any other components as required for refrigerant line lengths indicated by drawings. Provide all refrigerant and oil required for each refrigerant circuit.

#### 2.1.5. PROGRAMMABLE THERMOSTATS

Provide programmable thermostats with stages of cooling and heating as required by stages of cooling and heating on specified equipment (Refer to drawings and other portions of this specification to determine exact control required.)

Thermostat shall have the following:

- Seven (7) day programming capability with 2 occupied/unoccupied periods per day.
- Automatic heat/cool change over.
- Start time optimization
- Continuous fan operation in occupied mode.
- Intermittent fan operation in unoccupied mode.
- Battery backup
- Temporary override capability
- Locking setpoints to prevent tampering.
- Anti-recycle controls

Provide with all subbases required and interfaces to other equipment as required.

Coordinate with Electrical Contractor to provide all wiring between condensing units, furnaces, thermostats and all other required controls.

Provide Thermostats by Honeywell, Johnson Controls, White-Rogers, Trane, Carrier or approved equal.

#### 2.2. ROOFTOP HEATING AND COOLING UNITS

Owner will pre-purchase these items, contractor to receive and install.

Equivalents by Luxaire, Oxbox, or owner approved alternative only.

Provide dedicated downflow or horizontal gas heating electric cooling rooftop air handling units capable of operating range between 115°F and 0°F cooling as shown on plans. Cooling performance shall be rated in accordance with DOE and /or ARI testing procedures. Unit shall be factory assembled, internally wired, fully charged with R-410a and 100 percent run-tested before leaving the factory. Wiring internal to the unit shall be colored and numbered. Unit shall be UL listed and labeled, classified in accordance to ANSI Z21.47 for gas-fired central furnaces and UL 1995/CAN/CSA No. 236-M90 for central cooling air conditioners.

Minimum Seer shall be 13 for units five tons and smaller and 10 for units above 5 tons.

Unit casing shall be constructed of zinc coated, min. 18 ga., galvanized steel. Exterior surfaces shall be cleaned, phosphatized and finished with a weather-resistant baked enamel finish. Unit's surface shall be tested 500 hours in a salt spray test in compliance with ASTM B117. Cabinet construction shall allow for all maintenance on one side of the unit. Service panels shall have lifting handles and be removable while providing a water and airtight seal. The unit's base pan shall have no penetrations within the perimeter of the curb other than the raised 1-1/8" high

supply/return openings to provide an added water integrity precaution, if the condensate drain backs up. The base of the unit shall have provisions for forklift and crane lifting. The top cover shall be one piece or where seams exist, it shall be double hemmed and gasket sealed.

Unit shall have direct-drive hermetic, reciprocating type 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, internal temperature and current-sensitive motor overloads shall be included for maximum protection. Internal spring isolation and sound muffling shall be provided. External high pressure cutout shall be provided. Low pressure switches shall be standard.

Each refrigerant circuit shall have independent fixed orifice expansion devices, service pressure ports and refrigerant line filter driers. An area shall be provided for replacement suction line driers.

Provide internally finned 3/8" copper tubes mechanically bonded to configured aluminum plate fin evaporator and condenser coils. Coils shall be leak tested at the factory to ensure pressure integrity. The evaporator coil and condenser coil shall be leak tested to 200 psig and pressure tested to 450 psig.

The heating section shall have a drum and tube heat exchanger design using corrosion resistant steel components. A forced combustion blower shall supply premixed fuel to a single burner ignited by a pilotless hot surface ignition system. A negative pressure gas valve shall be used that requires blower operation to initiate gas flow. On an initial call for heat, the combustion blower shall purge the heat exchanger 45 seconds before ignition. After three unsuccessful attempts, the entire heating system shall be locked out until manually reset at the thermostat. Unit shall be suitable for use with natural gas. All units shall have two-stage heating.

The outdoor fans shall be direct-drive, statically and dynamically balanced, draw-through in the vertical discharge position. The fan motor shall be permanently lubricated and have built-in thermal overload protection.

Unit shall have belt driven, FC centrifugal fans with adjustable motor sheaves. Unit shall have an adjustable idler-arm assembly for quick-adjustment to fan belts and motor sheaves. All motors shall be thermally protected. Oversized motors shall be available for high static operations. Refer to schedule.

Unit shall be completely factory wired with necessary controls and contactor pressure lugs or terminal block for power wiring. Units shall provide an external location for mounting fused disconnect device. Micro-processor controls shall be provided for all 24 volt control functions. The resident control algorithms shall make all heating, cooling and/or ventilating decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures.

Provide roof curb designed to mate with the downflow unit and provide support and a watertight installation. The roof curb design shall allow field-fabricated rectangular supply/return ductwork to be connected directly to the curb. Curb design shall comply with NRCA requirements. Curb shall ship knocked down for field assembly and include wood nailer strips.

Provide field-installed circuit board to interface unit with 7-day programmable thermostat.

Economizer shall be factory installed. The assembly includes - fully modulating 0-100 percent motor and dampers, barometric relief, 10% minimum position setting, preset linkage, wiring harness with plug and fixed dry bulb control. The factory-installed economizer arrives in the shipping position and shall be moved to the operating position by the installing contractor.

Provide Farr 30/30 two-inch filters or equal.

Provide unit with louvered hail guards.

Provide low ambient accessories to allow operation to 0 degrees F.

### 2.3. GAS FIRED UNIT HEATER

Owner will pre-purchase these items, contractor to receive and install.

Equivalent by Reznor or owner approved alternative only.

Units shall be completely factory assembled, piped, wired and test fired. All units shall be AGA Certified and conform with the latest ANSI Standards for safe and efficient performance. Units shall be provided with two-point fan unit heaters and with four point suspension hangers on centrifugal fan unit heaters and duct furnaces. All units shall be available for operation on natural gas.

#### 2.3.1. CASING

Casing are die-formed, 20-gauge galvanized steel and finished in baked enamel. The bottom panel shall be easily removed to provide service access to the burners, pilot and orifices. The pilot shall be accessible through an access plate.

On duct furnaces the high limit switch shall be accessible through a side panel access.

Duct discharge flanges for simple ductwork connection shall be provided.

#### 2.3.2. HEAT EXCHANGER

Standard heat exchanger construction shall consist of seam welded 20-gauge aluminized steel tubes and 18-gauge aluminized steel headers.

#### 2.3.3. DRAFT DIVERTER

Standard draft diverter construction shall be corrosion resistant aluminized steel.

#### 2.3.4. BURNERS

Burners shall be die-formed, corrosion resistant aluminized steel, with stainless steel port protectors, Port protectors prevent scale or foreign matter from obstructing the burner ports. Burners shall be individually removable for ease of inspection and servicing. Each burner shall be provided with an individually adjustable, manually rotated air shutter adjustment. Air shutter adjustment shall be fixed on duct furnaces when the side access burner drawer is supplied.

#### 2.3.5. CONTROLS

A factory installed junction box shall be provided for all power connections. Standard units shall be provided with a 24-volt combination single-stage automatic gas valve, including main operating valve and pilot safety shutoff, pressure regulator, manual main and pilot shutoff valve, and adjustable pilot valve. Gas valve is suitable to a maximum inlet pressure of 0.5 psi (14-inch W.C.) on natural gas. A 24-volt control transformer, a spill (blocked vent) switch, high limit and fan time delay relay (optional on duct furnaces) shall be provided. The fan time delay relay delays the fan start until the heat exchanger reaches a predetermined temperature. It also allows the fan to operate after burner shutdown, removing residual heat from the heat exchanger.

#### 2.3.6. Modulating Gas Valve

Provides modulated heat output. Ignition is at low fire (50 percent input) and discharge temperature sensing bulb located in the air stream modulates the gas input from 50 percent to 100 percent rated input. Provided with an automatic electric valve in series which cycles the unit in response to a low voltage single-stage thermostat.

#### 2.3.7. Intermittent Pilot Ignition

Solid state ignition control system ignites the pilot by spark during each cycle of operation. When pilot flame is proven, main burner valve opens to allow gas flow to burners. Pilot and burners are

extinguished during off cycle. Required on California units.

#### 2.4. MINI SPLIT HEATING AND COOLING SYSTEMS

Owner will pre-purchase these items, contractor to receive and install.

Equivalents by Mitsubishi or owner approved alternative only.

Provide where shown on plans complete mini split system complete with all piping and electrical.

Systems shall be as scheduled.

### 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 15600

**SECTION 15955 - AUTOMATIC TEMPERATURE CONTROLS****1. PART 1 - GENERAL****1.1. RELATED DOCUMENTS**

Reference Section 15010. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2. SCOPE**

Furnish and install a complete electric control system for control of heating, ventilating, and air conditioning systems complete with thermostats, relays, valves, dampers, damper motors and other necessary facilities as specified, as indicated on the Drawings, and as required for a complete operable control system.

**2. PART 2 – PRODUCTS****2.1. EQUIPMENT**

Transformers shall be provided for supplying current to control equipment operating at less than 120 volts; shall be capable of supplying 125 percent of energy requirements of connected equipment and shall be enclosed in a NEMA I enclosure. Provide fused disconnect means on primary and secondary side. Provide voltage regulation if required for reliable operation of the system.

Thermostats shall be commercial grade.

**2.2. WIRING**

Electrical wiring required for the control system shall comply with DIVISION 16 and the following requirements:

Circuits operating at more than 50 volts shall be run in conduit or wireways. Wiring run in wireways with power conductors shall be separated by approved barriers in accordance with NEC. Circuits operating at 50 volts or less shall be run in rigid or flexible conduit, EMT, metal raceways or, if concealed, armored cable.

Wiring for low voltage circuits generally shall be No. 18 or larger and shall conform to NEC. Wiring sensitive to external fields shall be shielded. Shields shall be grounded to the electrical system grounding system. Wiring, whether individual or in cables, shall be color coded or numbered for identification.

**3. PART 3 – EXECUTION****3.1. CONTROL SYSTEM**

Control system and equipment shall be as specified and as indicated on the Drawings. All equipment shall be in accordance with NEMA and installed in accordance with these specifications. Install and adjust all equipment required for close regulation of temperatures and shall guarantee operation for a period of one year after substantial completion of the entire project. Complete diagrams and details of the system shall be submitted before starting Work.

One copy of the approved diagrams shall be framed under glass and wall mounted where directed by the Owner or Architect.

END OF SECTION 15955



**SECTION 15990 - SYSTEM TESTING & BALANCING****1. PART 1 - GENERAL****1.1. RELATED DOCUMENTS**

Reference Section 15010. 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

**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 15990

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**SECTION 16500 - ELECTRICAL EQUIPMENT**

**SECTION 16010 - ELECTRICAL 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 Electrical Contractor, all sub-contractors, and all material suppliers.

**1.2. SCOPE OF WORK**

This DIVISION requires the furnishing and installing of complete functioning Electrical 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 and Mechanical 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 conduit 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. 2949 SW Wanamaker Dr, Topeka, KS 66614, PHONE 785-273-2447, 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, conduit and other electrical work are indicated diagrammatically by electrical drawings. Layout work from dimensions on Architectural and Structural Drawings. Verify equipment size from manufacturers shop drawings.

Study and become familiar with contract drawings of other trades and in particular general construction drawings and details in order to obtain necessary information for figuring installation. Cooperate with other workmen and install work in such a way 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 conduit, apparatus, appliance or other electrical 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, subcontractor, workers or any cause whatsoever, shall be restored as specified for new work.

Do not scale electrical drawings for dimensions. Accurately layout work from dimensions indicated on 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 the Contractor to use their ingenuity and abilities to perform the work to their 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 conduits 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. ARCHITECTURAL VERIFICATION AND RELATED DOCUMENTS

Contractor shall consult all Architectural Drawings and specifications in their entirety incorporating and certifying all millwork, furniture, and equipment rough-in including utility characteristics such as

voltage, phase, amperage, pipe sizes, duct sizes, including height, location and orientation. Shop drawings incorporating these requirements should be submitted to the Architect for approval prior to installation or rough in.

#### 1.15. EXTENT OF CONTRACT WORK

Provide electrical systems indicated on drawings, specified or reasonably implied. Provide every device and accessory necessary for proper operation and completion of electrical systems. In no case will claims for "Extra Work" be allowed for work about which Electrical Contractor could have been informed before bids were taken.

Electrical Contractor shall be familiar with equipment provided by other Contractors that require electrical connections and control. Follow circuiting shown on drawings for lighting, power and equipment connections.

Make required electrical connections to equipment provided under Architectural and Mechanical divisions of this project. Receive and install electric control devices requiring field installation, wiring, and service connection. Equipment supplied by the automatic temperature control contractor shall be installed by the mechanical or automatic temperature control subcontractor. Make required internal field wiring modifications indicated on wiring diagrams of factory installed control systems for control sequence specified. These field modifications shall be limited to jumper connections and connection of internal wiring to alternate terminal block lugs. The cost for field modifications requiring rewiring of factory installed control systems for equipment provided by General or Mechanical Contractors shall be included in base bid of the respective contractor. All temperature control wiring shall be by a licensed electrician under the supervision of temperature control contractor.

Check electrical data and wiring diagrams received from Mechanical Contractor of compliance with project voltages, wiring, controls and protective devices shown on electrical drawings. Promptly bring discrepancies found to attention of Architect-Engineer for a decision.

Provide safety disconnect switches, contactors, and manual and magnetic motor starters for mechanical and electrical equipment requiring such devices. Omit these devices where included as part of factory installed prewired control systems provided with mechanical equipment. With exception of factory installed devices, provide safety disconnect switches, contacts and motor starters by one manufacturer to allow maximum interchangeability of repair parts and accessories for these devices.

To maximum extent possible electrical controls in boiler rooms, equipment rooms, and control rooms shall be grouped in accessible locations and arranged according to function. Where possible use group control panels and combination starters in lieu of individually enclosed devices.

#### 1.16. CODES, ORDINANCES, RULES AND REGULATIONS

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

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

#### 1.17. SAFETY CODES:

National Electrical Safety Code Handbook H30 - National Bureau of Standards

Occupational Safety and Health Standard (OSHA) Department of Labor

Safety Code for Elevators ANSI A17.1



**1.18. NATIONAL FIRE CODES:**

NFPA No. 54	Gas Appliances & Gas Piping Installation
NFPA No. 70	National Electric Code
NFPA No. 90A	Air Conditioning & Ventilation Systems
NFPA No. 91	Blower and Exhaust Systems
NFPA No. 101	Life Safety Code

**1.19. UNDERWRITERS LABORATORIES INC.:**

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

**1.20. MISCELLANEOUS CODES:**

ANSI A117.1 - Handicapped Accessibility

ASHRAE 90.1 1989

Americans with Disabilities Act (ADA)

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 Electrical Contractor proceeds with work knowing it to be contrary to any ordinances, laws, rules, and regulations he shall thereby have assumed full responsibility for and shall bear all costs required to correct non-complying work.

Electrical 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 review.

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.

**2. PART 2 – PRODUCTS**

Not Used

**3. PART 3 - EXECUTION****3.1. SHOP DRAWINGS**

Contractor shall furnish a minimum of six sets of shop drawings of all materials and equipment. Architect-Engineer will retain three sets.

Contractor shall submit two sets of prints of all fabrication drawings. Cost of drawing preparation, printing and distribution shall be paid for by the contractor and included in his base bid.

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 each submitted item with applicable section and sheet number of these specifications, or plan sheet number when item does not appear in the specifications. Where equipment submitted does not appear in base specifications or specified equivalent, mark submittals with applicable alternate numbers, change order number or letters of authorization. Each submittal shall contain at least two sets of original

catalog cuts. Each catalog sheet shall bear the equipment manufacturer's name and address. All shop drawings on materials and equipment listed by UL shall indicate UL approval on submittal.

Contractor shall check all shop drawings to verify that they meet specifications and/or drawings requirements before forwarding submittals to the Architect-Engineer for their review. All shop drawings submitted to Architect-Engineer shall bear contractor's approval stamp that shall indicate that Contractor has reviewed submittals and that they meet specification and/or 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 their supplier for re-submittal.

No shop drawing submittals will be considered for review by the Architect-Engineer without Contractor's approval stamp, or that have extensive changes made on the original submittal as a result of the Contractor's review.

The shop drawing submittal dates shall be at least as early as required to support the project schedule and shall also allow for two weeks Architect-Engineer review time plus mailing time plus a duplication of this time for re-submittal if required. Submittal of all shop drawings as soon as possible before construction starts is preferred. Submit the number of shop drawings required by the General Conditions but not less than 6 copies. All shop drawings submitted shall contain the following: The project name, the applicable specification section and paragraph, the submittal date, the Contractor's stamp which shall certify that the stamped drawings have been checked by the Contractor, comply with the drawings and specifications and have been coordinated with other trades. Submittals not so identified will be returned without action for re-submittal.

The Architect's-Engineer's checking and subsequent approval of such drawings, schedules, literature, or illustrations shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications unless he has, in writing, called the Architect's-Engineer's attention to such deviations at the time of submission, and secured their written approval; nor shall it relieve the contractor from responsibility for errors in dimensions, details, size of members, or omissions of components for fittings; or for coordinating items with actual building conditions and adjacent work.

Any corrections or modifications made by the Architect-Engineer shall be deemed acceptable to the Contractor at no change in price unless written notice is received by the Architect-Engineer prior to the performance of any work incorporating such corrections or modifications.

Shop drawings that require re-submission shall have the items that were revised "flagged" or in some other manner marked to call attention to what has been changed.

Before submitting shop drawings and material lists, verify that all equipment submitted is mutually compatible and suitable for the intended use. Verify that all equipment will fit the available space and allow ample room for maintenance. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.

Architect-Engineer's review of shop drawings will not relieve Contractor of responsibility for deviations from drawings and specifications unless the Architect-Engineer has specifically approved such deviations in writing, nor shall it relieve the Contractor of responsibility for errors in shop drawings. No work shall be fabricated until Architect-Engineer's review has been obtained. Any time delay caused by correcting and re-submitting shop drawings will be the Contractor's responsibility.

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

Submit with shop drawings of equipment, three sets of operating and maintenance instructions and parts lists for all items of equipment provided. Instructions shall be prepared by equipment manufacturer.

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

Prepare a complete brochure, covering systems and equipment provided and installed under his contract. Submit brochures to Architect/Engineer for review before delivery to Owner. Contractor at his option may prepare this brochure or retain an individual to prepare it for him. Include cost of this service in bid. Brochures shall contain following:

- Certified equipment drawings/or catalog data with equipment provided clearly marked as outlined under Section this specification.
- 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 system.
- Record Set Drawings: The Contractor shall mark up a set of contract documents during construction noting all changes and deviations including change orders. These will be delivered to Architect at end of the project. After the originals are changed to reflect the blue line set, a copy shall be included in the brochure.

Provide brochure bound in black vinyl 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., Electrical.

### 3.3. CUTTING AND PATCHING

Contractor shall do cutting and patching of building materials required for installation of work herein specified. Cut no structural members without Architect's approval and in a manner approved by him. Patching shall be by contractors of particular trade involved and shall meet approval of Architect.

Drilling and cutting of openings through building materials requires Architect'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.

Damage of building finishes caused by installation of electrical equipment, fixtures, outlets and other electrical devices shall be repaired at Contractor's expense to approval of Architect.

### 3.4. SETTING, ADJUSTMENT AND EQUIPMENT SUPPORTS

Work shall include mounting, alignment and adjustment of systems and equipment. Set equipment level on adequate foundations and provide proper anchor bolts and isolation as shown or specified. Level, shim, and grout equipment bases as recommended by manufacturer. Mount motors, align and adjust drive shafts and belts according to manufacturer's instruction. Equipment failures resulting from improper installation or field alignment shall be repaired or replaced by Contractor at no cost to Owner.

Provide electrical floor mounted equipment with 3-1/2" high concrete bases unless shown or specified otherwise. Electrical contractor shall size all pads. General contractor shall form all pads, provide and place all concrete 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. Electrical contractor shall arrange for attachment to building structure, unless otherwise indicated on drawings or as specified. Provide hangers with vibration eliminators where required. Contractor shall verify that structural members of building are adequate to support equipment. 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.

Provide 3-1/2" high concrete housekeeping pad as specified above where two or more conduits penetrate floor below panelboards.

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

Electrical 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, instructor's 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 video taped using digital format. At the end of the owner training, the "training tape" shall become the property of the Owner.

### 3.6. FINAL CONSTRUCTION REVIEW

At final construction review, Electrical Contractor and the major sub-contractors shall be present or shall be represented by a person of authority. Each Contractor shall demonstrate, as directed by Architect/Engineer, that the 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.

END OF SECTION 16010

**SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS****1. PART 1 - GENERAL****1.1. RELATED DOCUMENTS**

Reference Section 16010. 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. IDENTIFICATION OF WIRING AND EQUIPMENT**

Provide identification and warning signs to wiring and equipment as listed in schedule. Handwriting shall not be acceptable. Signs and tags shall be as follows:

- TYPE 1: Laminated phenolic plastic with black Gothic condensed lettering by Seton or Wilco.
- TYPE 2: Self-sticking ½” wide plastic tape with high gloss surface and embossed lettering by Brady, Seton or Dymo.
- TYPE 3: Self-sticking flexible vinyl with oil resistant adhesive for -20 degrees to 300 degrees F. temperatures by Brady, Seton or as approved.
- TYPE 4: Self-sticking polyester sign with wording and size conforming to ANSI Standard Z35.1-1964 and OSHA 19.0.144iii(2) Specifications, by Brady, Seton or as approved.

Provide lighting and power panelboards with Type 1 sign minimum of 1-1/4” x 6” indicating panel designation and electrical characteristics. Mount inside of panel door on circuit breaker trim flange just below breakers.

Provide disconnect switches, motor starters, time clocks, contactors and controllers, control panels, etc. with Type 1 sign ¾” x 5” indicating equipment served and “Warning Danger” sign.

Provide Type 2 tape at feeder terminal lugs to switchboards and panelboards. Tape shall indicate conduit size, conductor type and AWG size. Tape shall be located so as to be easily read with conductors installed.

Provide feeders and branch circuit home runs with Type 3 wire marker indicating circuit number and power source. Provide feeders phase identification letter at each terminal point in addition to its circuit number.

Provide electrical equipment and accessible wiring enclosures operating at voltage above 240 volts with Type 4 “Danger High Voltage” warning sign and voltage marker applied to front door or cover of device or enclosure. Provide large equipment such as transformers and main distribution equipment with Type 3 sign indicating all electrical characteristics.

Panels shall have branch circuit directory holders with clear plastic cover. Provide neatly typed list of branch circuit loads corresponding to branch circuit numbers.

All wires for branch circuit work shall be color coded.

### 3.2. NEUTRAL AND GROUND WIRES

Where individual circuit homeruns (hots, neutral, and ground as part of a single circuit) are indicated on the plans, these shall be individual circuits with individual neutrals and grounds (no sharing of neutrals and grounds).

Where shared circuit homeruns (hots, neutral, and ground as part of separate circuits) are indicated on the plans, these shall be allowed to share one (common) neutral for three (3) circuits from different phases occurring in one (1) conduit run. When additional circuits occur in conduit run, additional neutrals shall be installed. Conduit shall be upsized and conductors shall be de-rated based on NEC current carrying conductor tables counting all hots and neutrals as current carrying conductors.

### 3.3. CLEANING AND PAINTING OF MATERIALS AND EQUIPMENT

Before energizing switchboards, transformers, panelboards, starters, variable frequency drive and other similar electrical equipment, Contractor shall thoroughly vacuum out all dirt, duct and debris from inside of equipment and shall thoroughly clean outside and inside of equipment.

Touch-up painting and refinishing of factory applied finishes shall be by Electrical 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.

### 3.4. EXCAVATION AND BACKFILL

Perform necessary excavation to receive work. Provide necessary sheathing, shoring, cribbing, tarpaulins, etc. for this operation, and remove at completion of work. Perform excavation in accordance with appropriate section of these specifications, and in compliance with OSHA Safety Standards.

Excavate trenches of sufficient width to allow ample working space, and no deeper than necessary for installation work.

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 A/E.

Mechanically tamp backfill under concrete and pavings in 6" layers to 95% standard density, Reference Division 2.

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.

When available, refer to test hole information on architectural drawings or specifications for types of soil to be encountered in excavations.

### 3.5. FIRE BARRIERS

Provide sleeves through all fire-rated walls and fill voids surrounding sleeves and interior to sleeves around piping with Nelson "Flameseal" fire stop putty with U.L. listed 3 hour rating installed as per manufacturers recommendations.

Equivalent by Dow, Chemelex, 3M.

All holes or voids created by the electrical contractor to extend conduit or wiring through fire rated floors and walls shall be sealed with an intumescent material capable of expanding up to 8 to 10 times when exposed to temperatures of 250 degrees F. It shall have ICBO, BOCAI and SBCCI (NRB 243) approved ratings to 3 hours per ASTM E-814 (UL 1479). Acceptable Material: 3M Fire Barrier Caulk, Putty, Strip and sheet forms.

### 3.6. TEMPORARY COVERINGS

Provide temporary covering over all electrical panels, distribution panelboards, outlet boxes and other equipment as required to keep same free from damage due to moisture, plaster, paint, concrete or other foreign materials. Any equipment with finish damaged by moisture, paint, plaster or other foreign materials shall be cleaned and refinished as directed by the Architect without additional cost to the Owner.

All temporary openings in conduits shall be covered with metal or plastic caps.

END OF SECTION 16050

**SECTION 16200 - WIRING MEANS, METHODS, AND MATERIALS****1. PART 1 - GENERAL****1.1. RELATED DOCUMENTS**

Reference Section 16010. 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. CONDUITS**

Provide conduit by Republic, Allied Tube, Wheatland, Western, or approved equivalent.

All conduit delivered on the job shall be stored at least 12" above grade, roof, or floor. Keep the interior of all conduits clean. Conduits containing moisture or foreign material will not be accepted and shall be thoroughly cleaned and dried before installation.

**2.1.1. Steel Conduit**

Contractor may use either rigid steel or EMT for all main feeder circuits to switchboards and panelboards unless specifically indicated on plans.

**2.1.2. Galvanized Rigid Steel Conduit**

Conduit shall be hot dipped galvanized and shall bear a UL label. Conduit shall also meet Federal Specification W-WC-581 and ANSI C80.1.

**2.1.3. EMT Conduit**

Conduit shall be galvanized steel electrical metallic tubing and bear a UL label. Conduit shall conform to Federal Specification WWC-563 and ANSI specification C80.3.

**2.1.4. Outside and Wet Location Flexible Conduit**

Flexible conduit shall have a water resistant non-sleeving polyvinyl chloride jacket with a general temperature range of -40 degrees C to + 60 degrees C. Conduit shall bear a UL label.

**2.1.5. BX Flexible Conduit**

3/8" may only be used from JB to lighting fixture as per NEC 350. Other sizes shall be secured at 4-1/2 foot maximum intervals by mechanically fastening to structure. A ground wire shall be run in conduit. Contractor shall use flexible conduit for connections to motors and equipment mounted on resilient mounts or vibration isolators. Maximum length of flexible conduit shall be 8'-0".

**2.1.6. MC Cable and Romex**

MC cable and Romex are not allowed.

**2.2. CONDUIT FITTINGS**

Where conduits cross building expansion joints provide O-Z expansion fittings type "AX", "TE", "EX", or "EXE" as required.

Provide grounding bushings where feeder conduit attaches to panelboard backbox. Bond grounding bushing to ground bus.

**2.2.1. Rigid Steel Conduit**

Couplings shall be steel threaded type and box connectors shall be steel insulated bushings and malleable iron or steel locknuts. Unilets shall be malleable iron with blank cover.



### 2.2.2. EMT Conduit

Couplings and box connectors shall be die cast setscrew type. Unilets shall be malleable iron with blank cover.

### 2.2.3. Flexible Conduit

Connectors shall be threaded type iron with insulated throat.

## 2.3. PLASTIC CONDUIT

Provide rigid polyvinyl chloride (PVC) type EPC 40 heavy wall plastic conduit meeting current NEMA Standard TC-2. Conduit shall be listed UL 651 for underground and exposed use.

Plastic conduit may only be used for exterior underground applications or circuits beneath slabs on grade. Provide galvanized rigid steel (GRS) radius bends and risers as conduits rise above grade or above floor slab.

Provide exterior underground conduit with metal detection strip.

Provide matching plastic fittings. Fittings shall meet the same standards and specifications as the conduit on which it is installed.

Joining and bending of conduit and installation of fittings shall be done only by methods recommended.

Provide conduit support spacing as recommended for the highest ambient temperature expected.

Provide interlocking conduit spacers for multiple runs of underground conduits installed in same trench.

Provide expansion couplings on long runs regardless of ambient temperatures. Determine amount of conduit expansion and contraction from published charts or tables.

Plastic conduit and fittings shall be by a Products Division of Continental Oil Company.

## 2.4. INSERTS, HANGERS

Support vertical and horizontal conduit runs at intervals not greater than 10 feet, within 3 feet of any bend and at every outlet or junction box.

Install multiple runs of conduits as follows:

- Where a number of conduits are to be run exposed and parallel, group and support with trapeze hangers.
- Fasten hanger rods to structural steel members with suitable beam clamps and to concrete structures with inserts set flush with surface. Install concrete inserts with reinforced rod through opening provided in inserts.
- Inserts shall be Grinnell figure 279, 281, 282, or 285 or equivalent as required by load and concrete thickness.
- Provide beam clamps suitable for structural members and conditions.
- Provide 3/8" minimum diameter steel hangers rods galvanized or cadmium plated finish.
- Trapeze hangers shall be Kindorf Series 900 channels with fittings and accessories as required.
- Attach each conduit to trapeze hanger with Steel City No. C-105 clamps for rigid conduit and Steel City No. C-106 clamps for electrical metallic tubing. (EMT).

Install clamps for single conduit runs as follows:

- Support individual runs by approved pipe straps, secured by toggle bolts on hollow masonry; expansion shields and machine screws or standard preset inserts on concrete or solid masonry; machine screws or bolts on metal surfaces; and wood screws on wood construction. Use of perforated strap not permitted.
- Install exposed conduits in damp locations with clamp backs under each conduit clamp to prevent accumulation of moisture around conduits.

Provide inserts, hangers and accessories with finish as follows:

- Galvanized: Concrete inserts and pipe straps.
- Galvanized or Cadmium Plated: Steel bolts, nuts, washers and screws.
- Painted with Prime Coat: Individual hangers, trapeze hangers and rods.

Equivalent hangers and support systems by Binkley, Fee and Mason, Kin-Line or Unistrut.

## 2.5. BUSHINGS AND LOCKNUTS

Enter outlet boxes squarely and securely clamp conduit to outlet box with bushing on inside and locknut on outside.

## 2.6. SLEEVES

Provide proper type and size sleeves to General Contractor for electrical ducts, busses, conduits, etc. passing through building construction. Supervise installation to insure proper sleeve location. Unless indicated or approved install no sleeves in structural members.

Provide cast iron sleeves extending 1 inch above finished floor where sleeves pass through floors subject to flooding such as toilet rooms, bathrooms, equipment rooms and kitchen. Seal opening between pipe and sleeve with Thunderline Corp. Link Seal.

Unless specified otherwise provide 18 gauge galvanized sheet metal sleeves through floors and non-bearing walls. Where piping passes through exterior walls, equipment room walls, air plenum walls and walls between areas that must be isolated from occupied areas, seal space between sleeves and piping, air or water tight are required with Thunderline Corp. Link Seal.

Provide O-Z Electrical Manufacturing Co., Inc. Type "FSK" or "WSK" or equivalent thruwall and floor seals where conduits pass through concrete foundation walls below grade.

Provide Zurn Z-195 or equivalent flashing sleeve through walls and floors with waterproof membrane. Seal annular space between conduit and sleeve with Thunderline Link Seal or O-Z type CSM sealing bushing.

All holes or voids created by the electrical contractor to extend pipe through fire rated floors and walls shall be sealed with an intumescent material capable of expanding up to 8 to 10 times when exposed to temperatures of 250 degrees F. It shall have ICBO, BOCAI and SBCCI (NRB 243) approved ratings to 3 hours per ASTM E-814 (UL 1479). Acceptable Material: 3M Fire Barrier Caulk, Putty, Strip and sheet forms.

## 2.7. CONDUCTORS

Provide conductors by Encore, Southwire, Senator, Cerro, or approved equivalent.

Unless noted otherwise conductors referred to are wires and cable. Provide code grade soft annealed copper conductors with specified insulation type in proper colors to conform with color coding specified. Provide conductors No. 8 gauge and larger stranded and conductors No. 10 gauge and smaller shall be solid.

Use no conductors smaller than No. 12 gauge unless specifically called for or approved by Engineer. Size wire for volt branch circuits for 3% maximum voltage drop. Size feeder circuits for 2% maximum voltage drop. Combined voltage drop of feeders and branch circuits shall not exceed 5% maximum.

Provide conductors for listed applications as follows:

#### 2.7.1. Lighting and Receptacle Circuits

Type THWN, or THWN/THHN 600 volt, 75 degrees C (167°F) thermoplastic insulated building conductor or better.

#### 2.7.2. Lighting and Receptacles Circuits with No. 8 or larger conductors, motor circuits, power and feeder circuits and building service feeders

Type THHN/THWN 600 volts, 75 degrees C (167°F) thermoplastic insulated building conductor.

### 2.8. FIRE BARRIER

Provide sleeves through all fire-rated walls and fill voids surrounding sleeves and interior to sleeves around cables with Nelson "Flameseal" fire stop putty with U.L. listed 3 hour rating installed as per manufacturers recommendations.

Equivalent by Dow, Chemelex, 3M.

### 2.9. OUTLET BOXES

Provide electrical service outlets, including plug receptacles, lamp receptacles, lighting fixtures and switches with Steel City, Raco, or equivalent four inch code gauge steel knockout boxes galvanized or sheradized of required depth for service or device.

Provide code gauge galvanized steel raised covers on outlet boxes installed in plaster finish. Set to plaster grounds with outside edge of cover flush with plaster finish.

Provide 3/8" or larger fixture stud in each outlet box scheduled to receive lighting fixture. Select covers with proper opening for device installed in outlet box.

Use of utility of "Handy" boxes acceptable only where single gang flush outlet box in masonry is "dead-end" with only one conduit entering box from end or back.

Use no sectional outlet boxes.

Provide Appleton FS or FD unilets for surface mounted exterior work. Provide complete with proper device cover and gasket. Provide blank cover and gasket when used as junction box.

## 3. PART 3 - EXECUTION

### 3.1. CONDUIT INSTALLATION

Align conduit terminations at panelboards, switchboards, motor control equipment, junction boxes, etc. and install true and plumb. Provide supports or templates to hold conduit alignment during rough-in stage of work.

Install conduit continuous between outlet boxes, cabinets and equipment. Make bends smooth and even without flattening or flaking conduit. Radius of bends shall not be shorter than radius listed table 346-10 (b) of NEC. Long radius elbows may be used where necessary.

Ream and clean conduit before installation and plug or cover openings and boxes to keep conduit clean during construction.

Install no conduits or other raceways sized smaller than permitted in applicable NEC Tables. Where conduit sizes shown on drawings are smaller than permitted by code, Contractor shall include cost for proper size conduit in his base bid. In no case reduce conduit sizes indicated on drawings or specified without written approval of Architect-Engineer. Fasten conduit securely in place with approved straps, hangers, and steel supports. Provide O-Z cable support to support conductors in vertical raceways as required by NEC Table 300-19 (a) of NEC.

PVC conduit installation: Make square saw cut with fine tooth saw. Debur and round inside edge of the cut end. Clean socket ID and spigot OD of dirt and moisture. Apply a uniform coat of cement to spigot end and push into socket bottom, rotating ¼ turn. Allow time to set before disturbing, this will vary with ambient temperature. Test workmanship by conducting a low-pressure air (3.0-5.0 psi) test after system is installed and cemented joints are set. Plug and block ends to prevent movement prior to pressurization. Check for leaks at all joints with a soap solution. Even low-pressure air can cause high thrust loads and caution must be observed. The test shall be observed by the architect, engineer or owner's representative, prior to backfill. All below grade conduit must be watertight.

Low voltage wiring including fire alarm, telephone, television, computer cabling and other low voltage wiring shall be installed in conduit unless noted otherwise.

### 3.2. CONDUCTOR INSTALLATION

Run conductors in conduit continuous between outlets and junction boxes with no splices or taps pulled into conduits.

Neatly route, tie and support conductors terminating at switchboards, motor control centers, panelboards, sound equipment, etc., with Thomas & Betts Ty-Rap cable ties and clamps or equivalent by Electrovert or Panduit.

Make circuit conductor splices with Buchanan B series finger ease wire nuts or equivalent. Make fixture and device taps with Scotchlok self-stripping electrical tap connectors.

Terminate solid conductors at equipment terminal strips and other similar terminal points with insulated solderless terminal connectors. Terminate all stranded conductor terminal points with insulated solderless terminal connectors. Provide Thomas & Betts Sta-Kon insulated terminals and connectors or equivalent by API/AMP, Blackburn, Buchanan or Scotchlok "Wire Nuts".

One (common) neutral may be used for three (3) circuits from different phases occurring in one (1) conduit run. When additional circuits occur in conduit run, additional neutrals shall be installed.

Where a total of six or more control and feeder conductors terminate in a multiple device panel or enclosure that has no built-in terminal blocks provide Buchanan 600 volt heavy duty Type HO sectional terminal blocks with mounting channel and No. 23 see-thru covers. Equivalent terminal blocks by General Electric, Square D or Westinghouse.

Wrap conductor taps and connections requiring additional insulation with a minimum of three overlapped layers of 3M scotch vinyl plastic electrical type No. 88 or equivalent.

Install no conduits or wiring in air ducts, except that required to power devices that directly perform work upon air in the ductwork. No wiring shall be installed in any portion of grease ducts or airstreams of kitchen exhaust.

### 3.3. CONDUCTOR COLOR CODING

Provide continuous color coding for feeder, branch and control circuits. Insulation or identification tape color shall be same color for like circuits throughout. Where specified insulation colors are not

available in larger wire sizes color code conductor at all accessible locations with Scotch 35 all-weather color code tape. Identify the same phase conductor with same color throughout.

Provide grounding conductors #6 and smaller with green insulation. Provide grounding conductors larger than #6 identified with green vinyl tape.

Provide conductors with color coding in accordance with NEC. Where more than one standard voltage system is installed provide similarly colored conductors with indicated tape or stripe to indicate system voltage.

an engraved phenolic placard inside each panel door indicating the conductor color code.

END OF SECTION 16200

**SECTION 16300 - WIRING DEVICES AND SPECIALTIES****1. PART 1 - GENERAL****1.1. RELATED DOCUMENTS**

Reference Section 16010. 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**

Provide factory-fabricated wiring devices in types, colors, and electrical ratings for applications indicated. Wherever possible, devices shall be back and side wired. All switches and receptacles shall incorporate a metal mounting strap; non-metallic mounting straps are not acceptable. Switches shall be listed per UL 20 and certified by UL to Fed Spec. WS-596E. Receptacles shall be listed per UL 498 and certified by UL to Fed. Spec. WS-896E. Both switches and receptacles shall be visibly marked with the “UL-FS” mark to confirm certification. All devices shall be from the same manufacturer. Color of devices shall be Ivory.

**2.1. SWITCHES, RECEPTACLES AND COVER PLATES**

Provide where shown on plans Leviton wiring devices. Part numbers shall be as listed for each device specified. Equivalent devices by Bryant, Hubbell, General Electric, Arrow Hart, Pass & Seymour, Eagle.

**2.1.1. INDUSTRY REFERENCES**

Underwriter’s Laboratories (UL)

Switches (UL 20)

Receptacles, Plugs & Connectors (UL 498)

Pin & Sleeve Connectors (UL 1286)

Device Plates (UL 514)

GFCI’s (UL 943)

National Electric Manufacturers Association (NEMA)

WD-1 (Devices, Plates, Colors)

WD-6

Federal Specifications

Fed Spec Switches (WS-896E)

Fed Spec Receptacles (WC-596F)

Fed Spec Device Plates (W-P-455)

**2.2. RECEPTACLES****2.2.1. Receptacles**

Standard receptacles shall be equipped with a 20 ampere simplex or duplex plug receptacles as shown on the plans except where otherwise noted. Receptacles shall be 3 wire grounding type NEMA No. 5-20R. Receptacle shall be constructed with Nylon face and base; .050 gauge brass backstrap with one-piece ground design; riveted self-grounding clip; and .040 gauge solid brass, triple-wipe contacts.

### 2.2.2. Weatherproof receptacles

Weatherproof receptacles shall be equipped with a ground fault interrupter receptacle which will automatically detect a ground fault current and will de-energize receptacle when fault current exceeds 5 milliamps. GFCI shall be certified Class A by Underwriter's Laboratories.

Leviton #6898 with a hinged while in use weatherproof heavy duty cover.

### 2.2.3. GFCI Receptacles

GFCI receptacles shall detect a ground fault current and shall automatically de-energize receptacle when fault current exceeds 5 milliamps. GFCI shall be certified Class A by Underwriter's Laboratories, and listed under UL Standard 943. Receptacle shall be rated 20A. 120V. 2 pole, 3 wire grounding.

## 2.3. SWITCH AND RECEPTACLE FLUSH WALL PLATES

Wall plates for all flush outlets shall be satin stainless steel Type 302. All plates shall be listed per UL 514 and shall be of the same manufacturer as the devices furnished. Plates for surface mounted device outlets shall be drawn galvanized steel for steel boxes and cast for cast boxes.

Provide projecting mounted wiring devices with standard stainless steel wall plates with satin finish conforming to U.S. Bureau of Standards finish #32D.

Provide matching blank wall plates to cover outlet or junction boxes intended for future devices.

Provide matching blank wall plates with round knock out at all telephone outlet locations.

Provide factory engraved wall plates where indicated. Where engraved text is not outlined submit two copies of proposed text to A/E for review.

Where wall plates for special devices are available only from manufacturer of device, provide designs and finishes equivalent to above specification.

Verify with Architect finish of any plate where it may be apparent a special finish or color should have been specified.

Multiple switch plates shall be engraved to indicate what they control.

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

Install wiring devices to manufacturer's recommendations and in strict accordance with applicable sections of NEC.

Wall plates shall not support wiring devices. Provide wiring device with accessories as required to properly install devices and wall plates.

END OF SECTION 16300

**SECTION 16400 - ELECTRICAL DISTRIBUTION****1. PART 1 - GENERAL****1.1. RELATED DOCUMENTS**

Reference Section 16010. 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****2.1.1. BRANCH MOLDED CASE CIRCUIT BREAKERS**

Circuit breakers shall be thermal magnetic trip, with an integral crossbar to provide simultaneous opening of all poles in multi-pole circuit breakers.

Breakers shall have an overcenter, tripfree, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication.

Handles shall have “ON” and “OFF” and “Tripped” positions.

Circuit breakers shall be UL listed in accordance with UL standard 489 with current ratings as noted on the plans. Interrupting ratings shall be selected to provide the required short circuit current rating.

**2.1.2. SHORT CIRCUIT CURRENT RATING**

65,000 ampere rms symmetrical short circuit current ratings shall be provided. This rating shall be established by manufacturer testing of a representative meter center with branch overcurrent devices installed.

**3. PART 3 - EXECUTION**

All Electrical Distribution 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 16400



**SECTION 16500 - ELECTRICAL EQUIPMENT****1. PART 1 - GENERAL****1.1. RELATED DOCUMENTS**

Reference Section 16010. 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. DISCONNECT SWITCHES**

Provide heavy-duty horsepower rated Safety Switches rated in accordance with NEMA enclosed Switch Standard KS 1-1969 and L98 Standard.

Equivalents by: G.E., Cutler Hammer, or I.T.E. Siemens, or Square D.

Enclosure shall be NEMA type required by switch location and environment. Enclosure door shall latch with means for padlocking and cover interlock with defeater to prevent opening door when switch is energized or closing switch with door open. Switch shall have an embossed nameplate permanently attached to door front with switch rating, short circuit interrupting capacity and application information.

Line terminals shall be permanently marked and shielded. Contact shall be tin plated, equipped with arch chutes and have movable contacts visible in off position with door open. Wiring terminals shall be pressure type suitable for copper or aluminum wire. Switching mechanism shall be quick-make, quick-break spring driven anti-tease mechanism and shall be integral part of box. All current carrying parts shall be plated.

Fuse holders shall be high pressure suitable for use with dual element fuses or rejection type current limiting fuses where required. Fuse holders shall be completely accessible from front of switch and fuses shall be installed so that the label may be easily read from the front and without removing the fuse.

All fuse holders shall have rejection clips installed.

All disconnect switches as specified shall be installed in strict accordance with rules set forth by NEC.

**3. PART 3 - EXECUTION**

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

END OF SECTION 16500