PROJECT MANUAL

Computer Room
HVAC Renovations

AT

Eden Support Center

Contract No. CSD-2012-04

September 4, 2012

furlow associates, inc.
consulting engineers
1206 Society Drive
Claymont, Delaware

Christina School District

Computer Room HVAC Renovations
Eden Support Center

Invitation to Bid
Contract No. CSD-2012-04

September 4, 2012

- Deadline to Respond –
September 20, 2012
2:00 pm E.S.T.

CONTRACT NO. CSD-2012-04

ALL BIDDERS:

The enclosed packet contains an "INVITATION TO BID" for Eden Support Center Computer Room HVAC Renovations. The invitation consists of the following documents:

INVITATION TO BID - CONTRACT NO. CSD-2012-04

1 DEFINITIONS and GENERAL PROVISIONS
2 SPECIAL PROVISIONS and SPECIFICATIONS
3 BID QUOTATION REPLY SECTION
- A - NO BID REPLY FORM
- B - BID BOND
- C - NON-COLLUSION STATEMENT AND ACCEPTANCE
- D - QUOTATION SUMMARY
- E - OFFICE OF MINORITY AND WOMEN BUSINESS ENTERPRISE (OMWBE) APPLICATION

In order for your bid to be considered, the bid quotation reply section shall be executed completely and correctly and returned in a sealed envelope clearly displaying the contract number, by September 20, 2012, 2:00 pm (EST).

Bids shall be submitted to:

Christina School District
Attn: Nicholas Vacirca
Manager, Facilities Services
925 Bear-Corbitt Road
Bear, Delaware 19701

Please review and follow the information and instructions contained in the general and special provisions section of the invitation. Should you need additional information, please call 302-454-2400.

DEFINITIONS
AND
GENERAL PROVISIONS

The attached Definitions and General Provisions apply to all contracts and are part of each invitation to bid. The requirement to furnish a bid bond and performance bond is applicable unless waived in the Special Provisions. Should the General Provisions conflict with the Special Provisions, the Special Provisions shall prevail. Bidders or their authorized representatives are required to fully acquaint themselves as to State procurement laws and regulations prior to submitting bid.

DEFINITIONS

Whenever the following terms are used, their intent and meaning shall be interpreted as follows:

STATE: The State of Delaware

AGENCY: State Agency as noted on cover sheet.

DESIGNATED OFFICIAL: The agent authorized to act for the Agency.

BID INVITATION: The "bid invitation" or "invitation to bid" is a packet of material sent to vendors and consists of General Provisions, Special Provisions, specifications, and enclosures.

GENERAL PROVISIONS: General Provisions are instructions pertaining to contracts in general. They contain, in summary, requirements of laws of the State, policies of the Agency, and instructions to vendors.

SPECIAL PROVISIONS: Special Provisions are specific conditions or requirements peculiar to the contract under consideration and are supplemental to the General Provisions. Should the Special Provisions conflict with the General Provisions, the Special Provisions shall prevail.

BIDDER OR VENDOR: Any individual, firm, or corporation formally submitting a proposal for the material or work contemplated, acting directly or through a duly authorized representative.

PROPOSAL: The offer of the bidder submitted on the approved form and setting forth the bidder's prices for performing the work or supplying the material or equipment described in the specifications.

SURETY: The corporate body which is bound with and for the contract, or which is liable, and which engages to be responsible for the contractor's payments of all debts pertaining to and for its acceptable performance of the work for which it has contracted.

BIDDER'S DEPOSIT: The security designated in the proposal to be furnished by the bidder as a guaranty of good faith to enter into a contract with the Agency if the work to be performed or the material or equipment to be furnished is awarded to the bidder.

CONTRACT: The written agreement covering the furnishing and delivery of material or work to be performed.

CONTRACTOR: Any individual, firm, or corporation with whom a contract is made by the Agency.

CONTRACT BOND: The approved form of security furnished by the contractors and its surety as a guaranty of good faith on the part of the contractor to execute the work in accordance with the terms of the contract.

SECTION A - GENERAL PROVISIONS

1. **BID INVITATION**:

   See "Definitions".

2. **PROPOSAL FORMS**:

   The invitation to bid shall contain pre-printed forms for use by the vendor in submitting its bid. The forms shall contain basic information such as description of the item and the estimated quantities and shall have blank spaces for use by the vendor for entering information such as unit bid price, total bid price, etc.

3. **INTERPRETATION OF ESTIMATES**:

   a. The attention of bidders is called to the fact that, unless stated otherwise, the quantities given in the proposal form are to be considered to be approximate only and are given as a basis for the comparison of bids. The Agency may increase or decrease the amount of any item as may be deemed necessary or expedient, during the period of the contract.

   b. An increase or decrease in the quantity for any item is not sufficient ground for an increase or decrease in the unit price.

4. **SILENCE OF SPECIFICATIONS**:

   The apparent silence of the specifications as to any detail, or the apparent omission from it of detailed description concerning any point, shall be regarded as meaning that only the best commercial practice is to prevail and only material and workmanship of the first quality are to be used. Proof of specifications compliance will be the responsibility of the vendor.

5. **EXAMINATION OF SPECIFICATIONS AND PROVISIONS**:

   The bidder shall examine carefully the proposal and the contract forms for the material contemplated. The bidder shall investigate and satisfy itself as to the conditions to be encountered, quality and quantities of the material to be furnished, and the requirements of the Special Provisions and the contract. The submission of a proposal shall be conclusive evidence that the bidder has made examination of the aforementioned conditions.

6. **PREPARATION OF PROPOSAL**:

   a. The bidder's proposal shall be written in ink or typewritten on the form provided.

   b. If items are listed with a zero quantity, bidder shall state unit price **ONLY** (intended for open end purchases where estimated requirements are not known). The proposal shall show a total bid price for each item bid and the total bid price of the proposal excluding zero quantity items.

7. **PRICES QUOTED**:

The prices quoted are those for which the material will be furnished F.O.B. Ordering Agency and include all charges that may be imposed during the period of the contract.

8. **DISCOUNT**:

No qualifying letter or statements in or attached to the proposal, or separate discounts will be considered in determining the low bid except as may be otherwise herein noted. Cash or separate discounts should be computed and incorporated into unit bid price(s).

9. **SAMPLES OR BROCHURES**:

Samples or brochures may be required by the agency for evaluation purposes. They shall be such as to permit the Agency to compare and determine if the item offered complies with the intent of the specifications.

10. **PROPOSAL GUARANTY; BID BOND**:

a. Each bidder shall submit with its proposal a guaranty in sum equal to at least 10% of the total value of its bid, according to Delaware Code Title 29, Section 6927(a).

b. This bid bond shall be submitted in the form of good and sufficient bond drawn upon an insurance or bonding company authorized to do business in the State of Delaware, to the State of Delaware for the benefit of the Agency, or a certified check drawn on a reputable banking institution and made payable to the Agency in the requirement amount. If Agency bond form is not utilized, the substituted bond forms must conform to the minimum of conditions specified in the Agency bond form.

11. **DELIVERY OF PROPOSALS**:

Proposals shall be delivered in sealed envelopes, and shall bear on the outside the name and address of the bidder as well as the designation of the contract. Proposals forwarded by U.S. Mail shall be sent first class to the address listed below. Proposals forwarded by delivery service other than the U.S. Mail or hand delivered must be delivered to the address listed below. All bids must clearly display the bid number on the envelope.

Christina School District
Facilities Services
925 Bear-Corbitt Road
Bear, Delaware 19701

All proposals will be accepted at the time and place set in the advertisement. Bidder bears the risk of delays in delivery. Proposals received after the time set for public opening will be returned unopened.

12. **WITHDRAWAL OF PROPOSALS**:

A bidder may withdraw its proposal unopened after it has been deposited, if such a request is made prior to the time set for the opening of the proposal.

13. **PUBLIC OPENING OF PROPOSALS**:

The bids shall be publicly opened at the time and place specified by the Agency. Bidders or their authorized representatives are invited to be present.

14. **PUBLIC INSPECTION OF PROPOSALS**:

If the bidder designates a portion of its bid as confidential, it shall isolate and identify in writing the confidential portions. The bidder shall include with this designation a statement that explains and supports the firm's claim that the bid items identified as confidential contain trade secrets or other proprietary data.

15. **DISQUALIFICATION OF BIDDERS**:

Any one or more of the following causes may be considered as sufficient for the disqualification of a bidder and the rejection of its proposal or proposals:

a. More than one proposal for the same contract from an individual, firm, or corporation under the same or different names.

b. Evidence of collusion among bidders.

c. Unsatisfactory performance record as evidenced by past experience.

d. If the unit prices are obviously unbalanced either in excess or below reasonable cost analysis values.

e. If there are any unauthorized additions, interlineation, conditional or alternate bids or irregularities of any kind which may tend to make the proposal incomplete, indefinite, or ambiguous as to its meaning.

f. Non-attendance of mandatory pre-bid meetings may be cause of disqualification.

SECTION B - AWARD AND EXECUTION OF CONTRACT

1. **CONSIDERATION OF BIDS**:

a. After the proposals have been opened, the bids will be tabulated and the results will be made available to the public. Tabulations of the bids will be based on the correct summation of items at the unit price bid.

b. The right is reserved to waive technicalities, to reject any or all bids, or any portion thereof, to advertise for new proposals, to proceed to do the work otherwise, or to abandon the work, if in the judgment of the Agency or its agent, the best interest of the State will be promoted thereby.

2. **MATERIAL GUARANTY**:

Before any contract is awarded, the successful bidder may be required to furnish a complete statement of the origin, composition and manufacture of any or all of the material to be used in the contract together with such samples as may be requested for the purpose of testing.

3. **CONTRACT AWARD**:

Within thirty days from the date of opening proposals, the contract will be awarded or the proposals rejected.

4. **EXECUTION OF CONTRACT**:

   a. The bidder to whom the award is made shall execute a formal contract and bond within twenty days after date of official notice of the award of the contract.

   b. If the successful bidder fails to execute the required contract and bond, as aforesaid, within twenty days after the date of official notice of the award of the contract, its proposal guaranty shall immediately become forfeited as liquidated damages. Award will then be made to the next lowest qualified bidder of the work or re-advertised, as the Agency may decide.

5. **REQUIREMENT OF CONTRACT BOND**:

   a. Successful bidders shall furnish bond, simultaneously with the execution of the formal contract, to the State of Delaware for the benefit of the Agency with surety in the amount of 100% of the total contract award or as otherwise provided in the Special Provisions. Said bonds shall be conditioned upon the faithful performance of the contract.

   b. The bond forms shall be provided by the Agency and the surety shall be acceptable to the Agency.

6. **WARRANTY**:

   The successful bidder(s) shall be required to extend any policy guarantee usually offered to the general public, FEDERAL, STATE, COUNTY, or MUNICIPAL governments, on material in this contract against defective material, workmanship, and performance.

7. **THE CONTRACT(S)**:

   The contract(s) with the successful bidder(s) will be executed with the Christina School District – Facilities Services acting for all participating agencies.

8. **RETURN OF BIDDER'S DEPOSIT**:

   The deposits shall be returned to the successful bidder upon the execution of the formal contract. The deposits of unsuccessful bidders shall be returned to them immediately upon the awarding of the contract or rejection of their bids.

9. **INFORMATION REQUIREMENT**:

   The successful bidder's shall be required to advise the Christina School District – Facilities Services of the gross amount of purchases made as a result of the contract.

10. **CONTRACT EXTENSION**:

The State reserves the right to extend this contract on a month-to-month basis for a period of up to three months.

11. **TERMINATION FOR CONVENIENCE**:

Contracts shall remain in effect for the time period and quantity specified unless the contract is terminated by the State. The State may terminate the contract at any time by giving written notice of such termination and specifying the effective date thereof, at least sixty (60) days before the effective date of termination.

12. **TERMINATION FOR CAUSE**:

If, for any reasons, or through any cause, the Contractor fails to fulfill in timely and proper manner its obligations under this Contract, or if the Contractor violates any of the covenants, agreements, or stipulations of this Contract, the State shall thereupon have the right to terminate this contract by giving written notice to the Contractor of such termination and specifying the effective date thereof, at least 5 days before the effective date of such termination. In that event, all finished or unfinished documents, data, studies, surveys, drawings, maps, models, photographs, and reports or other material prepared by the Contractor under this Contract shall, at the option of the State, become its property, and the Contractor shall be entitled to receive just and equitable compensation for any satisfactory work completed on such documents and other materials which is usable to the State.

SECTION C - GENERAL

1. **AUTHORITY OF AGENCY**:

On all questions concerning the interpretation of specifications, the acceptability and quality of material furnished and/or work performed, the classification of material, the execution of the work, and the determination of payment due or to become due, the decision of the Agency shall be final and binding.

2. **LAWS TO BE OBSERVED**:

The contractor is presumed to know and shall strictly comply with all National, State, or County laws, and City or Town ordinances and regulations in any manner affecting the conduct of the work. The contractor shall indemnify and save harmless the State of Delaware, the Agency, and all Officers, Agency and Servants thereof against any claim or liability arising from or based upon the violation of any such laws, ordinances, regulations, orders, or decrees whether by itself or by its employees.

3. **PERMITS AND LICENSES**:

All necessary permits, licenses, insurance policies, etc. required by local, State or Federal laws, shall be provided by the contractor at its own expense.

4. **PATENTED DEVICES, MATERIAL AND PROCESSES**:

a. The contractor shall provide for the use of any patented design, device, material, or process to be used or furnished under this contract by suitable legal agreement with the patentee or owner, and shall file a copy of this agreement with the Agency.

b. The contractor and the surety shall hold and save harmless the State of Delaware, the Agency, the Director, their Officers or Agents from any and all claims because of the use of such patented design, device, material, or process in connection with the work agreed to be performed under this contract.

5. **EMERGENCY TERMINATION OF CONTRACT**:

a. Due to restrictions which may be established by the United States Government on material, or work, a contract may be terminated by the cancellation of all or portions of the contract.

b. In the event the contractor is unable to obtain the material required to complete the items of work included in the contract because of restrictions established by the United States Government and if, in the opinion of the Agency, it is impractical to substitute other available material, or the work cannot be completed within a reasonable time, the incomplete portions of the work may be cancelled, or the contract may be terminated.

6. **TAX EXEMPTION**:

a. Material covered by this proposal is exempt from all FEDERAL and STATE TAXES. Such taxes shall not be included in prices quoted.

b. Any material which is to be incorporated in the work or any equipment required for the work contemplated in the proposal may be consigned to the Agency. If the shipping papers show clearly that any such material is so consigned, the shipment will be exempt from the tax on the transportation of property under provisions of Section 3475 (b) of the Internal Revenue Code, as amended by Public Law 180 (78th Congress). All transportation charges shall be paid by the contractor. Each bidder shall take its exemption into account in calculating its bid for its work.

7. **OR EQUAL (PRODUCTS BY NAME)**:

Specifications of products by name are intended to be descriptive of quality or workmanship, finish and performance. Desirable characteristics are not intended to be restrictive. Substitutions of products for those named will be considered provided the vendor certifies that the function, characteristics, performance and endurance qualities of the material offered is equal or superior to that specified.

8. **BID EVALUATION AND AWARD**:

The Christina School District – Facilities Services will award this contract to the lowest responsible bidder(s) which in their judgment best serves the interest of the State of Delaware in accordance with Delaware Code Title 29, Section 6923(k). Personnel with experience and technical background may be utilized by the Christina School District – Facilities Services in making judgment. In case of error in price extension, the unit price(s) shall prevail.

9. **INVOICING**:

After the awards are made, the agencies participating in the bid may forward their purchase orders to the successful bidder(s) in accordance with State Purchasing Procedures. The State will generate a payment voucher upon receipt of an invoice from the vendor.

SECTION D - EQUAL OPPORTUNITY

1. **EQUALITY OF EMPLOYMENT OPPORTUNITY ON PUBLIC WORKS**:

During the performance of any contract for public works financed in whole or in part by appropriation of the State of Delaware, the contractor agrees as follows:

a. The contractor will not discriminate against any employee or applicant for employment because of race, creed, color, sex, age, or national origin. The contractor will take affirmative action to ensure that applicants are employed and that employees are treated equally during employment without regard to their race, creed, color, sex, age, or national origin. Such action shall include, but not be limited to the following: advertising, lay-off or termination, rates of pay or other forms of compensation, and selection for training including apprenticeships. The contractor agrees to post in conspicuous places, notices to be provided by the contracting agency setting forth the provisions of this non-discrimination clause.

b. The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, color, sex, age, or national origin.

c. The term "contractor for public works" means construction, reconstruction, demolition, alteration, and/or repair work, maintenance work, and paid for in whole or in part out of the funds of a public body except work performed under a vocational rehabilitation program. The manufacture or furnishing of materials, articles, supplies or equipment is not a public work within the meaning of this subsection unless conducted in connection with and at the site of the public work.

CONTRACT NO. CSD-2012-04
Eden Support Center Computer Room HVAC Renovations
SPECIAL PROVISIONS

1. **CONTRACT REQUIREMENTS**:

This contract will be issued to cover the Eden Support Center Computer Room HVAC Renovations requirements for Christina School District.

2. **CONTRACT PERIOD**:

Each vendor's contract shall be valid from October 10, 2012 to April 10, 2012.

3. **PRICES**:

Prices shall remain firm for the term of the contract.

4. **PRICE ADJUSTMENT**:

If during the initial term of the contract, the Vendor is not prohibited from offering a price reduction on its services or materiel offered under the contract. The State is not prohibited from requesting a price reduction on those services or materiel during the initial term or any subsequent options that the State may agree to exercise

If agreement is reached to extend this contract for the second, optional year, Christina School District – Facilities Services shall have the option of offering a determined price adjustment and shall not exceed the current Philadelphia All Urban Consumers Price Index (CPI-U), U.S. City Average. If the CPI-U is used, any increase/decrease shall reflect the change during the previous published twelve (12) month period at the time of renegotiation.

5. **SHIPPING TERMS**:

F.O.B. destination; freight pre-paid.

6. **QUANTITIES**:

The attention of bidders is called to the fact that, unless stated otherwise, the quantities given in the proposal are best estimates and are given as a basis for the comparison of bids. Quantities ordered may be increased or decreased by any eligible agency as deemed necessary during the period of the contract.

7. **FUNDING OUT**:

The continuation of this contract is contingent upon funding appropriated by the legislature.

8. **BID BOND REQUIREMENT**:

a. Each bidder shall furnish a bond to the State of Delaware for the benefit of Christina School District – Facilities Services in the amount equal to 10% of the respective bid

value. The bond shall be drawn upon an insurance or bonding company authorized to do business in the State of Delaware. If the enclosed standard State of Delaware bond form is not used, the substitute bond must reflect the minimum conditions specified in the standard form. A certified check made out to Christina School District – Facilities Services in an amount equal to 10% of the respective proposed value may be submitted in lieu of a proposal bond.

b. Bid Bond Waived.

9. **PERFORMANCE BOND REQUIREMENT**:

a. Contractors awarded contracts are required to furnish a 100% Performance Bond in accordance with Delaware Code Title 29, Section 6927, to the State of Delaware for the benefit of Christina School District – Facilities Services with surety in the amount of 100% of the specific award. Said bonds shall be conditioned upon the faithful performance of the contract. This guarantee shall be submitted in the form of good and sufficient bond drawn upon an Insurance or Bonding Company authorized to do business in the State of Delaware. If Christina School District – Facilities Services bond form is not utilized, the substituted bond form must reflect the minimum conditions specified in Christina School District – Facilities Services Bond Form.

b. Performance Bond Waived

10. **MANDATORY INSURANCE REQUIREMENTS**:

A. Certificate of Insurance and/or copies of insurance policies for the following:

1. As a part of the contract requirements, the contractor must obtain at its own cost and expense and keep in force and effect during the term of this contract, including all extensions, the minimum coverage limits specified below with a carrier satisfactory to the State. All contractors must carry Comprehensive General Liability and at least one of the other coverages depending on the type of service or product being delivered.

a. Comprehensive General Liability - $1,000,000.00 per person/$3,000,000 per occurrence.

and

b. Medical/Professional Liability - $1,000,000.00 per person/$3,000,000 per occurrence.

or

c. Miscellaneous Errors and Omissions - $1,000,000.00 per person/$3,000,000 per occurrence.

or

d. Product Liability - $1,000,000.00 per person/$3,000,000 per occurrence.

2. Automotive Liability Insurance covering all automotive units used in the work with limits of not less than $100,000 each person and $300,000

each accident as to bodily injury and $25,000 as to property damage to others.

3. Forty-five (45) days written notice of cancellation or material change of any policies is required.

Administrator, Nicholas Vacirca
Contract No. CSD-2012-04
State of Delaware
925 Bear-Corbitt Road
Bear, Delaware 19701

Note: The State of Delaware shall <u>not</u> be named as an additional insured.

B. Certificate of Insurance Waived.

11. **<u>BASIS OF AWARD</u>**:

Christina School District – Facilities Services shall award this contract to the lowest responsible and responsive bidder(s) who best meets the terms and conditions of the bid. The award will be made on basis of price, product evaluation, and prior history of service and capability.

Christina School District – Facilities Services reserves the right to reject any or all bids in whole or in part, to make multiple awards, partial awards, award by types, item by item, or lump sum total, whichever may be most advantageous to the State of Delaware.

12. **<u>STATE OF DELAWARE BUSINESS LICENSE</u>**:

Prior to receiving an award, the successful vendor shall either furnish Christina School District – Facilities Services with proof of State of Delaware Business Licensure or initiate the process of application where required. An application may be requested in writing to: Division of Revenue, Carvel State Building, P.O. Box 8750, 820 N. French Street, Wilmington, DE 19899 or by telephone to one of the following numbers: (302) 577-8201 - Public Service, (302) 577-8205 - Licensing Department.

Information regarding the award of this contract will be given to the Division of Revenue. Failure to comply with the State of Delaware licensing requirements may subject your organization to applicable fines and/or interest penalties.

13. **<u>HOLD HARMLESS</u>**:

The successful bidder agrees that it shall indemnify and hold the State of Delaware and all its agencies harmless from and against any and all claims for injury, loss of life, or damage to or loss of use of property caused or alleged to be caused, by acts or omissions of the successful bidder, its employees, and invitees on or about the premises and which arise out of the successful bidder's performance, or failure to perform as specified in the Agreement.

14. **<u>OWNERSHIP OF INTELLECTUAL PROPERTY:</u>**

All copyright and patent rights to all papers, reports, forms, materials, creations, or inventions created or developed in the performance of this contract shall become the sole

property of the State of Delaware. On request, the contractor shall promptly provide an acknowledgment or assignment in a tangible form satisfactory to the State to evidence the State's sole ownership of specifically identified intellectual property created or developed in the performance of the contract.

15. **NON-PERFORMANCE**:

In the event the vendor does not fulfill its obligations under the terms and conditions of this contract, the ordering agency may purchase equivalent product on the open market. Any difference in cost between the contract prices herein and the price of open market product shall be the responsibility of the vendor. Under no circumstances shall monies be due the vendor in the event open market products can be obtained below contract cost. Any monies charged to the vendor may be deducted from an open invoice.

16. **FORCE MAJEURE**:

Neither the vendor nor the ordering agency shall be held liable for non-performance under the terms and conditions of this contract due, but not limited to, government restriction, strike, flood, fire, or unforeseen catastrophe beyond either party's control. Each party shall notify the other in writing of any situation that may prevent performance under the terms and conditions of this contract.

17. **CONTRACTOR NON-ENTITLEMENT**:

State of Delaware Contractors for Materiel and for Services shall not have legal entitlement to, nor seek business from another Contractors' Central Contract. Additionally, they shall not utilize other Central Contracts to fulfill the requirements of their respective contract as they are not a "Covered Agency" as defined by Title 29 Chapter 69 of the State Procurement Code.

18. **EXCEPTIONS**:

Bidders may elect to take minor exception to the terms and conditions of this ITB. Christina School District – Facilities Services shall evaluate each exception according to the intent of the terms and conditions contained herein, but Christina School District – Facilities Services must reject exceptions that do not conform to State bid law and/or create inequality in the treatment of bidders. Exceptions shall be considered only if they are submitted with the bid or before the date and time of the bid opening.

19. **BUSINESS REFERENCES**:

In order to have your bid considered, please supply three (3) business references consisting of current or previous customers with your reply. Please include name, address, telephone number, and a contact person.

20. **ORDERING PROCEDURE**:

Successful contractors are required to have either a local telephone number within the (302) area code, a toll free (800) number, or agree to accept collect calls. Each agency is responsible for placing their orders and may be accomplished by written purchase order, telephone, fax or computer on-line systems. The contractor or vendor must accept full

payment by procurement (credit) card and/or conventional check and/or other electronic means at the State's option, without imposing any additional fees, costs or conditions.

21. **BILLING**:

The successful vendor is required to "Bill as Shipped" to the respective ordering agency(s). Ordering agencies shall provide contract number, ship to and bill to address, contact name and phone number.

22. **PAYMENT**:

The agencies or school districts involved will authorize and process for payment each invoice within thirty (30) days after the date of receipt of a correct invoice. The contractor or vendor must accept full payment by procurement (credit) card and/or conventional check and/or other electronic means at the State's option, without imposing any additional fees, costs or conditions.

23. **PRODUCT SUBSTITUTION**:

All items delivered during the life of the contract shall be of the same type and manufacture as specified or accepted as part of the bid proposal unless specific approval is given by Christina School District – Facilities Services to do otherwise. However, awarded vendors are highly encouraged to offer any like substitute product (s); either generic or brand name, at any time during the subsequent contract term, especially if an opportunity for cost savings to the state exists. In such cases, the state may require the submission of written specifications and/or product samples for evaluation prior to any approvals being granted.

24. **BID/CONTRACT EXECUTION**:

Both the non-collusion statement that is enclosed with this Invitation to Bid and the contract form delivered to the successful bidder for signature **shall** be executed by a representative who has the legal capacity to enter the organization into a formal contract with the State of Delaware, Christina School District – Facilities Services. The awarded vendor(s) will be required to complete the new W-9 Form by visiting the Division of Accounting's Website: http://accounting.delaware.gov.

25. **CONTRACTOR RESPONSIBILITY**:

The State will enter into a contract with the successful contractor. The successful contractor shall be responsible for all products and services as required by this ITB. Subcontractors, if any, shall be clearly identified in the financial proposal.

26. **PERSONNEL**:

a. The Contractor represents that they have, or will secure at their own expense, all personnel required to perform the services required under this contract.

b. All of the services required hereunder shall be performed by the Contractor or under its direct supervision, and all personnel, including subcontractors, engaged in the work shall be fully qualified and shall be authorized under State and local law to perform such services.

c. None of the work or services covered by this contract shall be subcontracted without the prior written approval of the State.

28. **LIFE CYCLE COSTING**:

If applicable, the specifications contained within this ITB have been developed through Life Cycle Cost Analysis that will allow the State to realize the lowest total cost of ownership and operation over the useful life of the equipment.

29. **ENERGY STAR PRODUCTS**:

The contractor **must** provide products that earn the ENERGY STAR rating and meet the ENERGY STAR specifications for energy efficiency. The offeror is encouraged to visit www.energystar.gov for complete product specifications and updated lists of qualifying products.

30. **TERMINATION FOR CONVENIENCE**:

Contracts shall remain in effect for the time period and quantity specified unless the contract is terminated by the State. The State may terminate the contract at any time by giving written notice of such termination and specifying the effective date thereof, at least sixty (60) days before the effective date of termination.

31. **TERMINATION FOR CAUSE**:

If, for any reasons, or through any cause, the Contractor fails to fulfill in timely and proper manner its obligations under this Contract, or if the Contractor violates any of the covenants, agreements, or stipulations of this Contract, the State shall thereupon have the right to terminate this contract by giving written notice to the Contractor of such termination and specifying the effective date thereof, at least 5 days before the effective date of such termination. In that event, all finished or unfinished documents, data, studies, surveys, drawings, maps, models, photographs, and reports or other material prepared by the Contractor under this Contract shall, at the option of the State, become its property, and the Contractor shall be entitled to receive just and equitable compensation for any satisfactory work completed on such documents and other materials which is usable to the State.

32. **VENDOR EMERGENCY RESPONSE POINT OF CONTACT**:

The awarded vendor(s) shall provide the name(s), telephone, or cell phone number(s) of those individuals who can be contacted twenty four (24) hours a day, seven (7) days a week to meet a critical need for commodities or services when the Governor of the State of Delaware declares a state of emergency under the current Delaware Emergency Operations Plan. Failure to provide this information could render the bid as non-responsive.

33. **ELECTRONIC CATALOG**:

The successful vendor(s) may be required to submit their items list in electronic format designated by the State.

Note: The State of Delaware is in the process of implementing a new financials system, which will require the use of:

- Electronic catalogs
- Commodity/classification code: United Nations Standard Products and Services Code (UNSPSC).
- A unique item ID for all items in our system

The state has made the determination to include the requirement in this contract for two reasons:

1. To find out what vendors can offer.
2. To give the agencies and school districts a level of comfort in using electronic catalogs.

TECHNICAL SPECIFICATIONS

DIVISION 1: GENERAL REQUIREMENTS

Section 010450 - Cutting and Patching
Section 012000 – Project Meetings
Section 017000 - Project Closeout
Section 017200 - Project Record Documents
Section 017300 - Operating and Maintenance Data

DIVISION 23: HVAC

Section 230200 – General Provisions – HVAC
Section 230210 – Basic Materials and Methods – HVAC
Section 230215 – Valves
Section 230230 – Insulation & Covering – HVAC
Section 230450 – Refrigeration Equipment – HVAC
Section 230600 – Air Distribution & Accessories – HVAC
Section 230760 – Air Handling Equipment
Section 230900 – Automatic Temperature Controls (DDC)
Section 230950 – Testing & Balancing of Mechanical Systems

DIVISION 26: ELECTRICAL

Section 260000 – General Provisions – Electrical
Section 260005 – Scope of Work – Electrical
Section 260055 – Electrical Identification
Section 260110 – Raceways
Section 260120 – Wires and Cables
Section 260121 – Wire Connections and Devices
Section 260135 – Electrical Boxes & Fittings
Section 260140 – Wiring Devices
Section 260160 – Panelboards
Section 260165 – Switchboards
Section 260170 – Motor and Circuit Disconnects
Section 260180 – Overcurrent Protective Devices
Section 260190 – Supporting Devices
Section 260400 – Electrical Distribution
Section 260402 – Underground Electric Service
Section 260430 – Metering Equipment
Section 260452 – Grounding
Section 260470 – Distribution Circuits
Section 260471 – Feeder Circuits
Section 260472 – Branch Circuits

BID QUOTATION REPLY SECTION

CONTRACT NO. CSD-2012-04

Eden support Center Compuer Room HVAC Renovations

Please fill out the attached forms fully and completely and return with your bid in a sealed envelope clearly displaying the contract number to Christina School District – Facilities Services by September 20, 2012, 2:00 pm (EST) at which time bids will be opened.

Bids shall be submitted to:

STATE OF DELAWARE
Christina School District
Facilities Services
925 Bear-Corbitt Road
Bear. Delaware 19701

PUBLIC BID OPENINGS

The public bid opening insures the citizens of Delaware that contracts are being bid fairly on a competitive basis and comply with Delaware procurement laws. The agency conducting the opening is required by law to publicly open the bids at the time and place specified and the contract shall be awarded within thirty (30) days thereafter. The main purpose of the bid opening is to reveal the name(s) of the bidders(s), not to serve as a forum for determining the apparent low bidders. The disclosure of additional information, including prices, shall be at the discretion of the contracting agency until such time that the responsiveness of each bid has been determined.

After receipt of a fully executed contract(s), the Delaware public and all bidders are invited to make an appointment with the contracting officer in order to review pricing and other non-confidential information.

NOTE: ONLY THE BIDDER'S NAME WILL BE READ AT THE BID OPENING

CONTRACT NO.: CSD-2012-04

BID QUOTATION

DELIVERY CONTRACT TOTAL VALUE $_____

Ship Stock _____ days ARO

Ship Non-Stock _____ days ARO

COMPANY

_____

_____

_____

Signature_____ Date: _____

STATE OF DELAWARE
CHRISTINA SCHOOL DISTRCIT
FACILITIES SERVICES
925 BEAR-CORBITT ROAD
BEAR, DELAWARE 19701

NO BID REPLY FORM

BID # CSD-2012-04 **BID TITLE:** Eden Support Center Computer Room HVAC Renovations

To assist us in obtaining good competition on our Request for Bids, we ask that each firm that has received an invitation, but does not wish to bid, state their reason(s) below and return in a clearly marked envelope displaying the contract number. This information will not preclude receipt of future invitations unless you request removal from the Bidder's List by so indicating below, or do not return this form or bona fide bid.

Unfortunately, we must offer a "No Bid" at this time because:

_____ 1. We do not wish to participate in the bid process.

_____ 2. We do not wish to bid under the terms and conditions of the Request for Bid document. Our objections are:

_____

_____

_____ 3. We do not feel we can be competitive.

_____ 4. We cannot submit a Bid because of the marketing or franchising policies of the manufacturing company.

_____ 5. We do not wish to sell to the State. Our objections are: _____

_____

_____ 6. We do not sell the items/services on which Bids are requested.

_____ 7. Other:_____

_____ _____
FIRM NAME SIGNATURE

_____ We wish to remain on the Bidder's List **for these goods or services**.

_____ We wish to be deleted from the Bidder's List **for these goods or services**.

10% BOND TO ACCOMPANY PROPOSAL
(NOT NECESSARY IF CERTIFIED CHECK IS USED)

KNOW ALL MEN BY THESE PRESENTS That _____ of _____ of the County of _____ and State of _____ principal, and _____ of _____ of the County of _____ and the State of _____ as surety, legally authorized to do business in the State of Delaware, are held and firmly bound unto the State of Delaware in the sum of _____ Dollars or _____ per cent (not to exceed _____ Dollars) of amount bid on Contract No. _____ to be paid to said State of Delaware for the use and benefit of the _____ of said State, for which payment well

(hereinafter referred to as Agency)

and truly to be made, we do bind ourselves, our and each of our heirs, executors, administrators, and successors, jointly and severally for and in the whole, firmly by these presents.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH That if the above bounden principal _____ who has submitted to said Agency of the State of Delaware, a certain proposal to enter into a certain contract to be known as Contract No. _____, for the furnishing of certain products and/or services within the said State of Delaware shall be awarded said Contract No. _____, and if said _____ shall well and truly enter into and execute said Contract No. _____ and furnish therewith such surety bond as may be required by the terms of said contract and approved by said Agency, said contract and said bond to be entered into within twenty days after the date of official notice of the award thereof in accordance with the terms of said proposal, then this obligation to be void or else to be and remain in full force and virtue.

Sealed with _____ seal and dated this _____ day of _____ in the year of our Lord two thousand and _____ (20___).

SEALED AND DELIVERED IN THE
Presence Of _____ _____ (Seal)
Name of Bidder (Principal)

Witness

_____ BY _____
(Seal)

Corporate
Seal

_____
Title

_____ BY _____ (Seal)
Name of Surety

_____ (Seal)

_____Title

CONTRACT NO.: CSD-2012-04
TITLE: Eden Support Center Computer Room HVAC Renovations
OPENING DATE: September 20, 2012

NON-COLLUSION STATEMENT

This is to certify that the undersigned bidder has neither directly nor indirectly, entered into any agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with this bid submitted this date to Christina School District – Facilities Services.

It is agreed by the undersigned bidder that the signed delivery of this bid represents the bidder's acceptance of the terms and conditions of this Invitation to Bid including all specifications and special provisions.

NOTE: Signature of the authorized representative **MUST** be of an individual who legally may enter his/her organization into a formal contract with the State of Delaware, Christina School District – Facilities Services.

COMPANY NAME _____ Check one)

	Corporation
	Partnership
	Individual

NAME OF AUTHORIZED REPRESENTATIVE
(Please type or print) _____

SIGNATURE _____ TITLE _____

COMPANY ADDRESS _____

PHONE NUMBER _____ FAX NUMBER _____

EMAIL ADDRESS _____

FEDERAL E.I. NUMBER _____ STATE OF DELAWARE LICENSE NUMBER _____

	(circle one)		(circle one)		(circle one)	
COMPANY CLASSIFICATIONS: CERT. NO._____	Women Business Enterprise (WBE)	Yes No	Minority Business Enterprise (MBE)	Yes No	Disadvantaged Business Enterprise (DBE)	Yes No

[The above table is for information and statistical use only.]

PURCHASE ORDERS SHOULD BE SENT TO:
(COMPANY NAME) _____

ADDRESS _____

CONTACT _____

PHONE NUMBER _____ FAX NUMBER _____

EMAIL ADDRESS _____

AFFIRMATION: Within the past five years, has your firm, any affiliate, any predecessor company or entity, owner, Director, officer, partner or proprietor been the subject of a Federal, State, Local government suspension or debarment?

YES _____ NO _____ if yes, please explain _____

_____

THIS PAGE SHALL BE SIGNED, NOTARIZED AND RETURNED FOR YOUR BID TO BE CONSIDERED

SWORN TO AND SUBSCRIBED BEFORE ME this _____ day of _____, 20 _____

Notary Public _____ My commission expires _____

City of _____ County of _____ State of _____

OMWBE Certification Application found here:
http://gss.omb.delaware.gov/omwbe/certify.shtml

State of Delaware

Office of Minority and Women Business Enterprise
Certification Application

Complete application and mail, email or fax to:

Office of Minority and Women Business Enterprise (OMWBE)
100 Enterprise Place, Suite 4
Dover, DE 19904-8202
Telephone: (302) 857-4554 Fax: (302) 739-3779
Email: deomwbe@state.de.us
Web site: www.deomwbe.delaware.gov

STATE OF DELAWARE
DEPARTMENT OF LABOR
DIVISION OF INDUSTRIAL AFFAIRS
225 Corporate Boulevard, Suite 104
Newark, Delaware 19702

TELEPHONE (302) 761-8200
(302) 451-3423
Fax (302) 368-6604

Via Facsimile and Regular Mail

May 25, 2012

Mr. William J. Slusser, Electrical Designer
Furlow Associates Inc.
1206 Society Drive
Claymont, DE 19703

Re: CSD-2012-04 Christina School District - Eden Support Center Data Room Air Conditioning, New Castle County, Delaware

Dear Mr. Slusser:

I am responding to your request for a category determination for Contract # CSD-2012-04 Christina School District - Eden Support Center Data Room Air Conditioning, which is a state funded construction project located in New Castle County, Delaware. The work consists of Electrical service and distribution, and addition of Air Conditioning to district data center. You estimate the total cost of construction for this project to be $500,000.00.

Based upon the information you provided the Department of Labor has determined that this project is a Building Construction project.

Delaware's Prevailing Wage Regulations provide that the rates applicable to a project are the rates in effect on the date of publication of the specifications for that project. I have enclosed a certified copy of the March 15, 2012, prevailing wage rates for Building Construction to be included in your bid specification. However, please be advised that, in the event that a contract for a project is not executed within one hundred and twenty (120) days from the earliest date the specifications were published, the rates in effect at the time of the execution of the contract shall be the applicable rates for the project.

If you have any questions or I can provide any additional assistance, please do not hesitate to contact me at (302) 451-3406.

Sincerely,

Ken Johnson
Labor Law Enforcement Officer
kennethw.johnson@state.de.us

Enclosure

RECEIVED
MAY 30 2012
FURLOW ASSOCIATES, INC

STATE OF DELAWARE
DEPARTMENT OF LABOR
DIVISION OF INDUSTRIAL AFFAIRS
OFFICE OF LABOR LAW ENFORCEMENT
PHONE: (302) 451-3423

Mailing Address:
225 CORPORATE BOULEVARD
SUITE 104
NEWARK, DE 19702

Located at:
225 CORPORATE BOULEVARD
SUITE 104
NEWARK, DE 19702

PREVAILING WAGES FOR **BUILDING CONSTRUCTION** EFFECTIVE MARCH 15, 2012

CLASSIFICATION	NEW CASTLE	KENT	SUSSEX
ASBESTOS WORKERS	23.22	29.83	39.20
BOILERMAKERS	65.47	33.22	48.83
BRICKLAYERS	45.63	45.63	45.63
CARPENTERS	49.06	49.06	39.22
CEMENT FINISHERS	40.38	29.11	21.20
ELECTRICAL LINE WORKERS	43.49	37.29	28.44
ELECTRICIANS	59.10	59.10	59.10
ELEVATOR CONSTRUCTORS	73.14	40.93	30.55
GLAZIERS	62.60	62.60	54.20
INSULATORS	50.38	50.38	50.38
IRON WORKERS	58.70	58.70	58.70
LABORERS	37.20	37.20	37.20
MILLWRIGHTS	60.85	60.85	47.42
PAINTERS	40.62	40.62	40.62
PILEDRIVERS	66.42	37.64	30.45
PLASTERERS	21.61	21.61	17.50
PLUMBERS/PIPEFITTERS/STEAMFITTERS	57.95	43.24	46.28
POWER EQUIPMENT OPERATORS	55.81	55.81	24.13
ROOFERS-COMPOSITION	21.01	20.71	17.02
ROOFERS-SHINGLE/SLATE/TILE	17.59	17.50	16.45
SHEET METAL WORKERS	64.39	62.18	62.18
SOFT FLOOR LAYERS	44.92	44.92	44.92
SPRINKLER FITTERS	50.65	50.65	50.65
TERRAZZO/MARBLE/TILE FNRS	50.50	50.50	45.45
TERRAZZO/MARBLE/TILE STRS	57.98	57.98	52.63
TRUCK DRIVERS	22.49	23.89	20.03

CERTIFIED: 5/29/12 BY: _____
ADMINISTRATOR, OFFICE OF LABOR LAW ENFORCEMENT

NOTE: THESE RATES ARE PROMULGATED AND ENFORCED PURSUANT TO THE PREVAILING WAGE REGULATIONS ADOPTED BY THE DEPARTMENT OF LABOR ON APRIL 3, 1992.

CLASSIFICATIONS OF WORKERS ARE DETERMINED BY THE DEPARTMENT OF LABOR. FOR ASSISTANCE IN CLASSIFYING WORKERS, OR FOR A COPY OF THE REGULATIONS OR CLASSIFICATIONS, PHONE (302) 451-3423.

NON-REGISTERED APPRENTICES MUST BE PAID THE MECHANIC'S RATE.

PROJECT: CSD-2012-04 Christina School District - Eden Support Center Data Room Air Conditioning, New Castle County

CS-1 COVER SHEET
A100 PARTIAL FLOOR PLANS ARCHITECTURAL
E100 PARTIAL FLOOR PLANS – DEMOLITION – ELECTRICAL
E110 PARTIAL FLOOR PLANS – ELECTRICAL
M000 LEGEND – MECHANICAL
M100 PARTIAL FLOOR PLANS – DEMOLITION – MECHANICAL
M110 PARTIAL FLOOR PLANS – MECHANICAL
M600 SCHEDULES & DETAILS – MECHANICAL
S101 PARTIAL FLOOR PLAN – STRUCTURAL, NOTES & DETAILS

SECTION 010450

CUTTING AND PATCHING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for cutting and patching.

B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

Requirements of this Section apply to mechanical and electrical installations. Refer to Division 26 Sections and drawings for other requirements and limitations applicable to cutting and patching electrical installations.

1.3 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.

B. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction cut and patched in a visually unsatisfactory manner.

1.4 WARRANTY

A. Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

PART 2 – PRODUCTS

2.1 MATERIALS, GENERAL

A. Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible if identical materials are unavailable or cannot be used. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.

B. Before proceeding, meet at the Project Site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage.

C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Avoid cutting existing pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

B. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

C. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining construction. Where possible, review proposed procedures with the original Installer; comply with the original Installer's recommendations.

D. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

E. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

F. Cut through concrete and masonry using a cutting machine, such as a Carborundum saw or a diamond-core drill.

G. Where services are required to be removed, relocated, or abandoned, by-pass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

H. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

I. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.

J. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

K. Where removing walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

Comment [COMMENT1]: INSERT SPECIFIC REFINISHING REQUIREMENTS FOR FLOORS, WALLS, AND CEILINGS. REVISE SUBPARAS BELOW TO SUIT PROJECT REQUIREMENTS.

L. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing the patch after the area has received primer and second coat.

3.4 CLEANING

A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

END OF SECTION 010450

SECTION 012000

PROJECT MEETINGS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:

1. Preconstruction conferences
2. Progress meetings

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Coordination" for procedures for coordinating project meetings with other construction activities.

2. Division 1 Section "Schedules & Reports" for submitting the Contractor's Construction Schedule.

1.3 PRECONSTRUCTION CONFERENCE

A. Schedule a preconstruction conference before starting construction, at a time convenient to the Owner and the Engineer, but no later than 15 days after execution of the Agreement. Hold the conference at the Project Site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

B. Attendees: Authorized representatives of the Owner and their consultants; the Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

C. Agenda: Discuss items of significance that could affect progress, including the following:

1. Early Submittal of Shop Drawings, Product Data and Samples.
2. Construction schedule.
3. Procedures for processing field decisions and Change Orders.
4. Procedures for processing Applications for Payment.
5. Preparation of record documents.
6. Use of the premises.
7. Parking availability.
8. Office, work and storage areas.
9. Equipment deliveries and priorities.
10. Safety procedures.

11. Security.
12. Housekeeping.
13. Working hours.

1.4 PROGRESS MEETINGS

A. Conduct progress meetings at the Project site at regular 2 week intervals. Notify the Owner and the Engineer of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.

B. Attendees: In addition to representatives of the Owner and the Engineer, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the status of the Project.

D. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to insure that current subsequent activities will be completed within the Contract Time.

E. Review the present and future needs of each entity present, including the following:

1. Interface requirements.
2. Time.
3. Sequences.
4. Status of submittals.
5. Hazards and risks.
6. Housekeeping.
7. Quality and work standards.
8. Change Orders.
9. Documentation of information for payment requests.

F. Reporting: No later than 3 days after each meeting, distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

G. Schedule Updating: Revise the Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 012000

SECTION 017000

PROJECT CLOSEOUT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provision of Contract, including General and Supplementary Conditions and other Division - 1 Specification Sections, apply to this section.

1.2 SUMMARY

A. This section specifies administrative and procedural requirements for project closeout, including but not limited to:

1. Inspection procedures.
2. Project record document submittal.
3. Operating and maintenance manual submittal.
4. Submittal of warranties.
5. Final cleaning.

B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions – 23.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.

1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.

2. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.

3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.

4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.

5. Deliver tools, spare parts, extra stock, and similar items.

6. Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.

7. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

8. Complete final cleanup requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

B. Punch List Procedures: On receipt of a request for punch list, the Engineer will either proceed with punch list or advise the Contractor of unfilled requirements. The Agency will prepare the Certificate of Substantial Completion following punch list, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. The Engineer will repeat punch list when requested by the Agency and assured that the Work has been substantially completed.

2. Results of the completed punch list by the Contractor will form the basis of requirements for final acceptance.

1.4 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final punch list for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.

3. Submit consent of surety to final payment.

4. Submit an Affidavit of Payment of Debts and Claims.

5. Submit letter of Guarantee.

B. Repeat Punch List Procedure: The Engineer will review the Work upon receipt of notice that the Work, including punch list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Agency and Engineer.

1. If necessary, reinspection will be repeated until all punch list items have been addressed or corrected. All punch list meetings en route to satisfying the requirement that “all punch list items have been corrected” will be considered necessary punch list meetings required by this specification and the ensuing contract.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 CLOSEOUT PROCEDURES

A. FINAL CLEANING

1. General: General cleaning during construction is required by the General Conditions.

2. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

3. Complete the following cleaning operations before requesting review for Certification of Substantial Completion.

    a. Remove labels that are not permanent labels.

    b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

    c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave floors broom clean. Vacuum carpeted surfaces. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

    d. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

4. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

5. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

    a. Where extra materials of value remaining after completion of associated work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION 017000

SECTION 017200

PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other conditions, if any) and Division 1 and Division 23, apply to the work of this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for Project Record Documents.

B. Project Record Documents required include:

1. Marked-up copies of Reproducible Contract Drawings.
2. Newly prepared Drawings.
3. Field records for variable and concealed conditions
4. Per this contract, provide to the Owner a complete set of “as-built” drawings on disk.

C. Specific record copy requirements that expand requirements of this Section are included in the individual Sections of Divisions 23 and 26.

D. General project closeout requirements are included in Section "Project Closeout".

E. Maintenance of Documents and Samples: Store record documents apart from Contract Documents used for construction. Do not permit Project Record Documents to be used for construction purposes. Maintain record documents in good order, and in a clean, dry legible condition.

1.3 RECORD DRAWINGS

A. Markup Procedure: During the construction period, maintain a set of blue- or black-line white prints of Contract Drawings and Shop Drawings for Project Record Document purposes.

1. Mark these Drawings to indicate the actual installation where the installation varies appreciably from the installation shown originally. Give Particular attention to information on concealed elements which would be difficult to identify or measure and record later. Items required to be marked include but are not limited to:

a. Dimensional changes to the Drawings.
b. Revisions to details shown on the Drawings.
c. Revisions to routing of piping and conduits.
d. Revisions to electrical circuitry.
e. Actual equipment locations.
f. Duct size and routing.
g. Locations of concealed internal utilities.

h. Changes made by Change Order.
i. Details not on original Contract Drawings

2. Mark completely and accurately record prints of Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions. Where Shop Drawings are marked, show cross-reference on Contract Drawings location.

3. Mark record sets with red erasable colored pencil; use other colors to distinguish between changes for different categories of the Work at the same location.

4. Mark important additional information which was either shown schematically or omitted from original drawings.

5. Note construction change directive numbers, alternate numbers, change order numbers and similar identification.

6. Responsibility for Markup: Where feasible, the individual or entity who obtained record data, whether the individual or entity is the installed, subcontractor, or similar entity, is required to prepare the markup on record drawings.

   a. Accurately record information in an understandable drawing technique.

   b. Record data as soon as possible after it has been obtained. In the case of concealed installations, record and check the markup prior to concealment.

B. Immediately prior to inspection for Certification of Substantial Completion, review completed marked-up record Drawings with the Engineer. When authorized, prepare a full set of reproducible of Contract Drawings.

C. Incorporate changes and additional information previously marked on print sets. Erase, redraw and add details and notations where applicable. Identify and date each Drawing; include the printed designation "PROJECT RECORD DRAWINGS" in a prominent location on each Drawing.

D. Refer instances of uncertainty to the Engineer for resolution.

E. One set of original Contract Drawings will be furnished to the Contractor by the Engineer, if necessary, for use in recording changes and additional information. Other printing as required is the Contractor's responsibility.

F. The Contractor is responsible for printing original other Drawings as required to produce record drawings.

G. Before copying and distributing, submit corrected drawings and the original marked-up prints to the Engineer for review. When acceptable, the Engineer will initial and date each corrected drawing, indicating acceptance of general scope of changes and additional information recorded, and of the quality of drafting.

1. Corrected drawings and the original marked-up prints will be returned to Contractor for organizing into sets, printing, binding and final submittal.

H. Copies and Distribution: After completing the preparation of reproducible record drawings, print 1 blue-line or black-line print of each Drawing, whether or not changes and additional information were recorded. Organize the copies into manageable sets. Bind each set with appropriate identification, including titles, dates and other information on cover sheet identifying them as record drawings and the contractor preparing them.

1. Organize and bind original marked-up set of prints that were maintained during the construction period in the same manner.

2. Organize record documents into sets matching the print sets.

3. Submit the marked-up record set, reproducible drawings and 1 copy of prints to the Engineer for Owner's records.

I. Newly Prepared Record Drawings: Prepare new drawings instead of following procedures specified for preparation of record Drawings where new drawings are required by a Change Order issued as a result of acceptance of an alternate, substitution or other modification, and the Engineer determines that neither the original Contract Drawings nor Shop Drawings are suitable to show the actual installation.

1. Consult with the Engineer for the proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. When completed and accepted, integrate newly prepared drawings with procedures specified for organizing, copying, binding and submittal of record drawings.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.1 RECORDING

A. Post changes and modifications to the Documents as they occur. Do not wait until the end of the Project.

END OF SECTION 017200

SECTION 017300

OPERATING AND MAINTENANCE DATA

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for operating and maintenance manuals including the following:

1. Preparation and submittal of operating and maintenance manuals for building operating systems or equipment.

2. Preparation and submittal of instruction manuals covering the care, preservation and maintenance of architectural products and finishes.

3. Instruction of the Owner's operating personnel in operation and maintenance of building systems and equipment.

B. Special operating and maintenance data requirements for specific pieces of equipment or building operating systems are included in the appropriate Sections of Divisions-2 through -16.

C. Preparation of Shop Drawings and Product Data are included in General and Supplementary Conditions.

D. General closeout requirements are included in General and Supplementary Conditions, and Section 01700.

E. General requirements for submittal of Project Record Documents are included in General and Supplementary Conditions, and Section 017200.

1.3 QUALITY ASSURANCE

A. Maintenance Manual Preparation: In preparation of Maintenance Manuals, use personnel thoroughly trained and experienced in operation and maintenance of the equipment or system involved.

1. Where written instructions are required, use personnel skilled in technical writing to the extent necessary for communication of essential data.

2. Where Drawings or diagrams are required, use draftsmen capable of preparing Drawings clearly in an understandable format.

B. Instructions for the Owner's Personnel: For instruction of the Owner's operating and maintenance personnel, use experienced instructors thoroughly trained and experienced in the operation and maintenance of the building equipment or system involved.

1.4 SUBMITTALS

A. Submittal Schedule: Comply with the following schedule for submittal of operating and maintenance manuals.

1. Before substantial completion, when each installation that requires submittal of operating and maintenance manuals is nominally complete, submit two draft copies of each manual to the Architect for review. Include a complete index or table of contents of each manual.

2. The Architect will return one copy of the draft with comments within fifteen days of receipt.

3. Submit one copy of data in final form at least fifteen days before final punch list. This copy will be returned within fifteen days after final punch list, with comments.

4. After final punch list make corrections or modifications to comply with the Architect's comments. Submit the specified number of copies of each approved manual to the Architect within fifteen days of receipt of the Architect's comments.

B. Form of Submittal: Prepare operating and maintenance manuals in the form of an instructional manual for use by the Owner's operating personnel. Organize into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder.

C. Binders: For each manual, provide heavy-duty, commercial quality, durable 3-ring vinyl-covered looseleaf binders, in thickness necessary to accommodate contents, sized to receive 8-1/2" by 11" paper. Provide a clear plastic sleeve on the spine, to hold labels describing the contents. Provide pockets in the covers to receive folded sheets.

1. Where two or more binders are necessary to accommodate data, correlate data in each binder into related groupings in accordance with the Project Manual table of contents. Cross-reference other binders where necessary to provide essential information for proper operation or maintenance of the piece of equipment or system.

2. Identify each binder on the front and spine, with the typed or printed title "OPERATION AND MAINTENANCE MANUAL", Project title or name, and subject matter covered. Indicate the volume number for multiple volume sets of manuals.

D. Dividers: Provide heavy paper dividers with celluloid covered tabs for each separate Section. Mark each tab to indicate contents. Provide a typed description of the product and major parts of equipment included in the Section on each divider.

E. Text Material: Where written material is required as part of the manual, use the manufacturer's standard printed material, or if it is not available, specially prepared data, neatly typewritten, on 8-1/2" by 11", 20-pound white bond paper.

F. Drawings: Where drawings or diagrams are required as part of the manual, provide reinforced punched binder tabs on the drawings and bind in with the text.

1. Where oversize drawings are necessary, fold the drawings to the same size as the text pages and use as a foldout.

2. If drawings are too large to be used practically as a foldout, place the drawing, neatly folded in the front or rear pocket of the binder. Insert a typewritten page indicating the drawing title, description of contents and drawing location at the appropriate location in the manual.

1.5 MANUAL CONTENT

A. In each manual include information specified in the individual Specification Section, and the following information for each major component of building equipment and its controls:

1. General system or equipment description
2. Design factors and assumptions
3. Copies of applicable Shop Drawings and Product Data.
4. System or equipment identification, including:

    a. Name of manufacturer
    b. Model number
    c. Serial number of each component

5. Operating instructions
6. Emergency instructions
7. Wiring diagrams
8. Inspection and test procedures
9. Maintenance procedures and schedules
10. Precautions against improper use and maintenance
11. Copies of warranties
12. Repair instructions including spare parts listing
13. Sources of required maintenance materials and related services
14. Manual Index

B. Organize each manual into separate Sections for each piece of related equipment. As a minimum each manual shall contain a title page, a table of contents, copies of Product Data, supplemented by drawings and written text, and copies of each warranty, bond and service Contract issued.

1. Title Page: Provide a title page in a transparent plastic envelope as the first sheet of each manual. Provide the following information:

    a. Subject matter covered by the manual
    b. Name and address of the Project
    c. Date of submittal
    d. Name, address and telephone number of the Contractor.
    e. Name and address of the Architect
    f. Cross reference to related systems in other operating and maintenance manuals

C. Table of Contents: After the Title Page, include a typewritten table of contents for each volume, arranged systematically according to the Project Manual format.

D. Include a list of each product included, identified by product name or other appropriate identifying symbol and indexed to the content of the volume.

Where more than one volume is required to accommodate data for a particular system, provide a comprehensive table of contents for all volumes in each volume of the set.

E. General Information: Provide a general information Section immediately following the Table of Contents, listing each product included in the manual, identified by product name. Under each product , list the name, address and telephone number of the Subcontractor or installer, and the maintenance contractor. Clearly delineate the extent of responsibility of each of these entities. In addition, list a local source for replacement parts and equipment.

F. Product Data: Where manufacturer's standard printed data is included in the manuals, include only sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where more than one item in a tabular format is included, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation and delete references to information that is not applicable.

G. Written Text: Where manufacturer's standard printed data is not available, and information is necessary for proper operation and maintenance of equipment or systems, or it is necessary to provide additional information to supplement data included in the manual, prepare written test to provide necessary information. Organize the text in a consistent format under separate headings for different procedures. Where necessary, provide a logical sequence of instruction for each operating or maintenance procedure.

H. Drawings: Provide specially prepared drawings where necessary to supplement manufacturer's printed data to illustrate the relationship of component parts of equipment or systems, or to provide control or flow diagrams. Coordinate these drawings with information contained in Project Record Drawings to assure correct illustration of the completed installation.

Do not use original Project Record Documents as part of the Operating and Maintenance Manuals.

Warranties, Bonds and Service Contracts: Provide a copy of each warranty, bond or service contract in the appropriate manual for the information of the Owner's operating personnel. Provide written data outlining procedures to be followed in the event of product failure. List circumstances and conditions that would affect validity of the warranty or bond.

1.6 EQUIPMENT AND SYSTEMS MAINTENANCE MANUAL

A. Submit three copies of each completed manual on equipment and systems, in final form, to the Architect for distribution. Provide separate manuals for each unit of equipment, each operating system, and each electric and electronic system.

Refer to Specification Sections for additional requirements on operating and maintenance of the various pieces of equipment and operating systems.

B. Equipment and Systems: Provide the following information for each piece of equipment, each building operating system, and each electric or electronic system.

1. Description: Provide a complete description of each unit and related component parts, including the following:

    a. Equipment or system function
    b. Operating characteristics
    c. Limiting conditions
    d. Performance curves
    e. Engineering data and tests
    f. Complete nomenclature and number of replacement parts

2. Manufacturer's Information: For each manufacturer of a component part or piece of equipment provide the following:

    a. Printed operating and maintenance instructions
    b. Assembly drawings and diagrams required for maintenance
    c. List of items recommended to be stocked as spare parts

3. Maintenance Procedures: Provide information detailing essential maintenance procedures, including the following:

    a. Routine operations
    b. Trouble-shooting guide
    c. Disassembly, repair and reassembly
    d. Alignment, adjusting and checking

4. Operating Procedures: Provide information on equipment and system operating procedures, including the following:

    a. Startup procedures
    b. Equipment or system break-in
    c. Routine and normal operating instructions
    d. Regulation and control procedures
    e. Instructions on stopping
    f. Shutdown and emergency instructions
    g. Summer and winter operating instructions
    h. Required sequences for electric or electronic systems
    i. Special operating instructions

5. Servicing Schedule: Provide a schedule of routine servicing and lubrication requirements, including a list of required lubricants for equipment with moving parts.

6. Controls: Provide a description of the sequence of operation and as-installed control diagrams by the control manufacturer for systems requiring controls.

7. Coordination Drawings: Provide each Contractor's Coordination Drawings.

8. Provide as-installed color-coded piping diagrams, where required for identification.

9. Valve Tags: Provide charts of valve tag numbers, with the location and function of each valve.

10. Circuit Directories: For electric and electronic systems, provide complete circuit directories of panelboards, including the following:

    a. Electric service
    b. Controls
    c. Communication

1.7 INSTRUCTIONS OF THE OWNER'S PERSONNEL

A. Prior to final acceptance, instruct the Owner's personnel in operation, adjustment, and maintenance of products, equipment and systems. Provide 4 hours of instruction at a mutually agreed upon time.

1. For equipment that requires seasonal operation, provide similar instruction during other seasons.

2. Use operation and maintenance manuals for each piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of operation and maintenance.

3. All training shall be video-taped for the Owner’s use at a future date. Video taping shall be provided by the firm performing the training.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 017300

SECTION 230200

GENERAL PROVISIONS - HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to work of this Section.

B. This specification or drawing and the design features or resulting construction disclosed, are the property of Furlow Associates, Inc., and shall not be reproduced without written permission.

C. All Mechanical Systems shall be part of and included in all of the following: 230200 thru 230950

1.2 WORK INCLUDED

A. Provide labor, materials, equipment and supervision necessary to install complete operating HVAC Systems, including all work at the site and within the proposed construction areas to accomplish the required work.

B. Wherever the term "provide" is used, it shall be understood to mean both "furnish" and "install".

1.3 REGULATIONS, CODES AND STANDARDS

A. Work shall be performed in accordance with latest adopted codes, regulations and ordinances by authorities having jurisdiction. Observe all safety regulations.

B. Obtain all permits and inspection certificates and pay all charges.

C. Latest editions of any referenced standards shall govern.

1.4 RELATED WORK

A. Refer to equipment shown or specified in sections of Division 1 thru 14 and 26 that will require Mechanical services and provide such service.

B. Refer to work related to HVAC as shown on the following contract drawings:

Architectural & Structural
Plumbing
Electrical

C. This Contractor shall coordinate with the work of Division 26 and the Fire Alarm System vendor for locations and mounting of all duct smoke detectors. These devices are shown on the Mechanical Drawings for reference only to show the intent of the work. All locations shall be determined based on approved shop drawings from the Fire Alarm System vendor and the Contractor for the work of Division 16, Electrical.

1.5 COORDINATION

A. The Mechanical, Plumbing and Electrical Contractors are responsible to coordinate all manufacturer's recommended circuit breakers, starters, disconnects and fuse sizes for all equipment. Submission of a shop drawing will certify that this has been completed. Any necessary changes required will be included as part of this contract.

B. Mechanical Contractor shall coordinate scheduling, submittals and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of independent work elements, with provisions to accommodate items that may be installed at a later time.

C. Mechanical Contractor shall verify utility requirements and all characteristics of operating equipment are compatible with the building utilities. Coordinate the work of all sections related and required for installing, connection and placing in service of all equipment.

D. Mechanical Contractor shall coordinate all space requirements, supports and installation of all mechanical, electrical, plumbing and fire protection work, which are indicated diagrammatically on the Drawings. Verify routing of all pipes, ducts, conduits and equipment connections. Maximize accessibility for other work, and service requirements for maintenance and repairs.

E. Obtain written confirmation from all related trade Contractors and the Owner or his representative that requirements, conflicts and coordination issues have been discussed and resolved.

F.Submit coordination drawings to verify access and clearances.

1.6 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations..

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installation within unheated shelters.

1.7 SUBMITTALS

A. Shop Drawings:

1. Shop drawings shall be submitted in accordance with Division 1 of these specifications except where herein modified.

2. Shop drawings comprising complete catalog cuts, performance test data for HVAC equipment as required by other sections of Division 23, shall be submitted for review checking. The Contractor shall review these shop drawings for conformance to contract documents prior to submission and affix contractor's signature to each submittal certifying that this review has been done. By approving and submitting shop drawings, product data, samples and similar materials, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction data that relates to the work, and has checked and coordinated this information with all of the requirements contained in the contract documents for the work of all trades.

    a. The Contractor and equipment manufacturer shall clearly indentify in all submittals and shop drawings any and all applications standards which require additional work to accommodate this equipment and provide a complete and operational system as described in the contract documents.

    b. The Contractor shall be completely responsible for any and all additional costs associated with the changes required by this and all other trades.

3. Submit a 1/4" scale layout of all mechanical equipment rooms. All equipment and pads shall be to scale of equipment being furnished. Obtain size information of any and all equipment from other trades and indicate on drawings. The drawings shall be fully coordinated with all trades prior to submission. Indicate coil pull areas, filter pull areas, maintenance clearances, and access as applicable.

4. All shop drawing submittals shall have the following identification data, as applicable, contained therein or permanently adhered thereto.

    a. Project name.

    b. Project number.

    c. Sub-contractor's, vendor's and/or manufacturer's name and address.

    d. Product identification.

    e. Identification of deviation from contract documents.

    f. Applicable contract drawings and specification section number.

    g. Shop drawing title, drawing number, revision number, and date of drawing and revision.

5. Resubmit revised or additional shop drawings as requested.

6. Wherever shop drawings or vendor's standard data sheets indicate work to be done "by others", it shall be the responsibility of the contractor making the submission to identify by name, the contractor who is to do this work. If the contractor named is other than the contractor making the

submission, the shop drawing submission must be reviewed by the named contractor and bear his mark of approval, prior to submission to the Architect/Engineer.

7. Where equipment proposed differs from that shown on the drawings or specified, he shall submit for approval drawings showing the manner in which the layout is affected by the substitution.

8. The Contractor shall keep one copy of approved shop drawings at the job site,, filed in a suitable metal container. The shop drawings shall be cataloged and kept in good repair, and shall be available for use by the Owner, Architect and Engineer.

9. No equipment shall be ordered, fabricated, etc., before approval of shop drawings.

B. Contractor is responsible for the shop drawing coordination and interface with the work of other contracts and adjacent work. The relationship of Contractor's work shall be verified as it relates to adjacent and critical features of the work of this and all contracts and materials.

C. The Contractor shall submit a complete schedule of all shop drawings required for the scope of work covering all materials and equipment listed in all sections of Division 15, Mechanical, including all documents required for contract closeout, Owner instructions and training, and all turnover items at the completion of the work. This schedule shall be submitted for review and approval within thirty days of contract award and before any subsequent materials are provided for review.

D. The shop drawings provided by the Contractor will be reviewed only once and resubmittals will be reviewed only once. Any other submittals will be billed to the Contractor at the Engineer's standard rates.

1.8 SITE INSPECTION

A. The Contractor shall visit site, inspect, and become aware of all conditions which may effect the work during the estimation phase of his work prior to bid openings. Investigate utilities, protection requirements for adjacent facilities, storage locations, and access to the construction area.

B. Submission of a bid will be deemed evidence of having complied with this requirement.

1.9 SUBSTITUTIONS

A. Whenever a material, article, piece of equipment or system is identified in the following specification or indicated on the drawings by reference to manufacturers' or vendors' names, trade names, catalog numbers or the like, it is so identified for the purpose of establishing the basis of the Bid.

B. Substitution approval must be obtained and included as an addendum item prior to the submission of the bid. An approved substitution shall not be considered as an approval for the Contractor or an equipment vendor to deviate from the written portion of the specifications unless so stated in the addendum.

C. The drawings illustrate the space allocated for equipment and the Contractor shall install the equipment accordingly. If changes are required in the building or arrangement due to substitution of equipment, the Contractor making the substitution must pay for the necessary modifications.

D. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall

include, but not be limited to all: space requirements, code clearances, type-horsepower-capacities-number and size of services required from other trades including all auxiliary items provided by this Contractor and all other trades, and all manufacturer's specific equipment applications standards and requirements, for approved equipment including that which is basis of design or a substitution. The bidding related contractor and equipment manufacturers shall clearly identify in all submittals and shop drawings any and all applications standards which require additional work to accommodate this equipment and provide a complete and operational system as described in the contract documents. If the bidding contractor or manufacturer does not comply with these requirements then they shall be completely responsible for any and all additional costs associated with the changes required by this and all other trades.

E. Where only one brand name or manufacturer is identified, no substitutions are permitted.

F.Substitutions:

1. Until a date no later than seven (7) days before the date Bids are due, Architect will consider written requests from bidders for substitution of Products. Architect will review requests and will notify Bidders in an Addendum if the requested substitution is acceptable.

2. Submit a separate request for each Product, supported with complete data, with drawings and samples as appropriate, including:

    a. Comparison of the qualities of the proposed substitution with that specified.

    b. Changes required in other elements of the work because of the substitution.

    c. Effect on the construction schedule.

    d. Cost data comparing the proposed substitution with the Product specified.

    e. Any required license fees or royalties.

    f. Availability of maintenance service, and source of replacement materials.

3. Architect shall be the judge of the acceptability of the proposed substitution.

4. A request for a substitution constitutes a representation that Bidder:

    a. Has investigated the proposed Product and determined that it is equal to or superior in all respects to that specified.

    b. Will provide the same warranties or bonds for the substitution as for the Product specified.

    c. Will coordinate the installation of an accepted substitution into the work, and make such other changes as may be required to make the work complete in all respects.

    d. Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.

1.10 LUBRICATION

A. Provide and maintain all required lubrication of any equipment operated prior to acceptance by the Owner. Lubrication shall be as recommended by the equipment manufacturer.

B. Provide one year's supply of lubricants to Owner at date of acceptance.

C. Verify that required lubrication has taken place prior to any equipment start-up.

1.11 EQUIPMENT START-UP

A. Verify proper installation by manufacturer or his representative.

B. Advise Owner's Representative 2 days prior to actual start-up.

C. Verify proper operation. Obtain signed statement by manufacturer or his representative that equipment is operating within warranty requirements. Submit statement to Owner's Representative.

D. Perform field mechanical balancing in accordance with Section 230950: TESTING AND BALANCING OF MECHANICAL SYSTEMS.

E. The Mechanical Contractor shall own as part of his work, the following:

Provide one (1) additional drive set, if necessary, to obtain final design balancing requirements. The Mechanical Contractor shall coordinate with Balancing Firm and equipment manufacturer for drive selection, including belts and pulleys.

1.12 OPERATION & MAINTENANCE INSTRUCTIONS

A. Properly and fully instruct Owner's personnel in the operation and maintenance of all systems and equipment.

B. Insure that the Owner's personnel are familiar with all operations to carry on required activities.

C. Such instruction shall be for each item of equipment and each system as a whole.

D. Provide report that instruction has taken place. Include in the report the equipment and/or systems instructed, date, contractor, Owner's personnel, vendor, and that a complete operating and maintenance manual has been reviewed.

E. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalogue cuts, complete schedule of air filters for each unit type in Excel spreadsheet format, wiring diagrams, piping diagrams, control sequences, service requirements, names and addresses of vendors, suppliers and emergency contacts. Three manuals shall be provided.

F. Submit manuals for review prior to operating instruction period. Manuals shall be 8-1/2 x 11" with hard cover, suitably bound.

G. Provide to the Owner any special tools necessary for operation and routine maintenance of any of the equipment.

H. Upon completion of the project, the Mechanical Contractor shall provide a complete set of legible as-built drawings for the Owner.

1.13 TOOLS

A. All equipment furnished by the Mechanical Contractor which requires special tools or devices other than those normally available to the maintenance or operating staff shall be furnished in duplicate to the Owner, sufficiently marked, packed or boxed for staff usage. The tools provided shall be listed by the Mechanical Contractor identified as to their use or the equipment applicable in a written transmittal to the Owner.

1.14 CLEANING AND FINISHING

A. After equipment start-up and all operating tests have been made and the system pronounced satisfactory, each respective Contractor shall go over the entire project, clean all equipment, etc., installed by him and leave in a clean and working condition. Any surfaces found marred after this final cleaning shall be refinished or replaced by each Contractor at no cost to the Owner.

B. Provide for the safety and good condition of all materials and equipment until final acceptance by the Owner. Protect all materials and equipment from damage. Provide adequate and proper storage facilities during the progress of the work. Special care shall be taken to provide protection for bearings, open connections, pipe coils, pumps, compressors and similar equipment.

C. All fixtures, piping, finished surfaces and equipment shall have all grease, adhesive labels and foreign materials removed.

D. All piping shall be drained and flushed to remove grease and foreign matter. Pressure regulating assemblies, traps, and similar items shall be thoroughly cleaned. Remove and thoroughly clean and reinstall all liquid strainer screens after the system has been in operation ten (10) days.

E. When connections are made to existing systems, the Mechanical Contractor shall do all cleaning and purging of the existing systems required to restore them to the condition existing prior to the start of work.

F.Clean-up: Remove from the premises, all unused material and debris resulting from the performance of work under this section.

PART 2 – PRODUCTS

2.1 GENERAL

A. All material and equipment shall be new and of present day manufacture, and shall conform to accepted standards of the trade where such a standard has been established for the particular type of equipment or material.

B. Whenever equipment or material is referred to in the singular, such as "the fan", it shall be deemed to apply to as many such items as necessary to complete the work.

2.2 PRODUCT DELIVERY, STORAGE AND HANDLING

A. During loading, transporting and unloading exercise care to prevent damage to material.

B. Store all materials in dry enclosures or under protective coverings out of way of work progress.

C. Material shall not be allowed to be stored directly on ground.

D. Deliver in manufacturer's original cartons or on skids.

E. Handle and protect so as to prevent damage to product or any surrounding material.

2.3 CONCRETE

A. Concrete shall be in accordance with ACI-613.

2.4 WARRANTY

A. Wherever in the specification sections of this division, reference is made to a specific warranty period, this warranty shall be in addition to and not a limitation of other rights the Owner may have against the Mechanical Contractor under the contract documents.

PART 3 – EXECUTION

3.1 PROTECTION

A. Plug or cap open ends of piping systems, conduit and ductwork.

B. Stored materials shall be covered to prevent damage by inclement weather, sun, dust or moisture.

C. Protect all installed work until accepted in place by the Owner.

D. Plates, polished metal escutcheons, thermostats and other finished devices shall not be installed until masonry, tile, and painting operations are complete unless otherwise protected.

E. Protect all work from operations which may cause damage such as hauling, welding, soldering, painting, insulating and covering.

3.2 WORKMANSHIP

A. Install all work neat, trim and plumb with building lines.

B. Install work in spaces allocated.

C. Cutting and patching shall be performed by skilled tradesmen normally employed for the work involved.

D. This Contractor shall provide a complete weathertight seal to all new systems in the building including the necessary caulking, weather-stripping and insulation.

3.3 EQUIPMENT SETTING

A. Provide as a minimum, a 4 inch concrete pad beneath all grade-mounted equipment. Install anchor bolts in pour.

B. Concrete shall be 3,000 psi, 28 day compressive strength in accordance with ACI-613. Reinforce with No. 4 rod 12" on centers both ways or as otherwise detailed.

3.4 FASTENERS, HANGERS AND SUPPORTS

A. Provide all hangers and supports required to suspend, mount, or hang the work.

B. Provide all miscellaneous steel angles, channels, beams, clips, brackets and anchors necessary to hang or support the work. Provide submissions for review.

C. Install concrete inserts before concrete is poured.

D. Drilled inserts shall not be loaded more than 1/4 rated capacity.

E. Power-driven fasteners shall not be allowed for piping larger than 2 inch, or equipment. When used they shall not be loaded more than 1/8 rated capacity or 200 pounds.

F.All hangers, miscellaneous steel, braces and supports shall be galvanized, cadmium plated, or primed steel. Copper tubing shall be supported with copper hangers.

G. Piping shall be supported from adjustable clevis type hangers with insulation pipe saddles or pipe shields in accordance with piping support spacing table on the drawings. Where hangers are 18" or longer provide lateral bracing at every fourth hanger.

H. Support vertical piping at floor levels. Piping shall have split rings.

I. Any lintels required for openings for this work if not indicated on Architectural or Structural drawings shall be provided under this Section.

3.5 SLEEVES

A. Provide each pipe, duct or conduit passing through a masonry or concrete wall, floor or partition with a sleeve made from standard weight steel pipe for pipe or conduit and No. 12 gauge galvanized steel for ducts, with smooth edges, securely and neatly cemented in place. Provide each pipe, duct or conduit passing through a frame or metal partition with a sleeve made from No. 22 gauge galvanized sheet metal, securely fastened in place.

B. Be responsible for the proper location and alignment of all sleeves.

C. Provide hydrostatic seals for sleeves passing through outside walls, either above or below grade, or through hydrostatically sealed slabs or floors on grade. Provide fire-rated seals for all sleeves which penetrate fire-rated walls.

D. Install both piping and sleeve seals so as to maintain integrity of seals with expansion and contraction of piping.

E. Set floor sleeves flush with floor surface in finished areas, 1" above the finished floor in kitchens, cafeterias, and similar service areas unless such areas are slab-on-grade; 1" above the floor in mechanical rooms, pipe chases, pipe spaces and other unfinished areas, unless otherwise indicated, and flush with the underside of slabs. Extend wall and partition sleeves through and cut flush with each surface unless otherwise indicated or specified.

F. Select sleeves two pipe sizes larger than any pipe or conduit that is to remain uncovered, unless otherwise required by the sealing method specified. Where pipes are to be covered, provide sleeves large enough to allow the covering to pass through the sleeves with sufficient clearance for sealing as specified hereinafter. Size sleeves for branch piping from vertical risers large enough to permit vertical expansion at the riser.

G. Place sleeves imbedded in concrete floors or walls in the forms before concrete is poured; sleeves shall have integral waterstop flanges, where they are to receive either watertight or hydrostatic seals.

H. Install sleeves passing through above-grade floors of mechanical rooms, toilet rooms, kitchens or similar service areas where liquid leaks or spillover may occur in a watertight manner. Sleeves shall be such that waterproofing membrane can be flashed around and into the sleeve where necessary.

I. Hydrostatic Sealing Method: Provide compressible synthetic rubber seals, equivalent to LINK SEAL, manufactured by the Thunderline Corporation, or THRUWALL manufactured by O.Z. Gedney. Install seals in accordance with the manufacturer's recommendations to provide air tightness aboveground and hydrostatic sealing belowgrade. Caulking or other type mastic is not acceptable.

J. Fire-Rated Sealing Method:

1. Sleeves, openings and sealants shall comply with applicable codes, recommended practices and standards, and manufacturer's instructions. Fire sealants shall have ability to prevent spread of flame, smoke or water throughout the penetration and shall pass 3 hour test, UL test ASTM E814 and UL 1479.

2. Products: Chase Corporation CTC PR-855, O. Z. Gedney CRS/CAFS, 3M Electro-Products Division Putty 303 or Caulk CP25 penetration sealing kits, General Electric Company sealants type RTV-850, 6428 or 7403, Thunderline Corporation "Link-Seal Pyro-Pak". Installation and type of sealant to be used as recommended by the manufacturer.

3.6 PLATES

A. Provide chrome plated plates wherever piping passes into finished area.

B. Plates shall be securely fastened to piping or building construction.

C. Floor plates shall cover 1 inch sleeve extension.

3.7 OFFSETS, TRANSITIONS, MODIFICATIONS

A. Provide all offsets necessary to install the work and to provide clearance for other trades.

B. Maintain adequate headroom and clearance.

C. Incidental modifications necessary to the installation of the systems shall be made as necessary and as approved by the Architect.

3.8 RECESSES

A. Furnish information to the General Contractor as to sizes and locations of recesses required to install panels, boxes, and other equipment or devices which are to be recessed in walls.

B. Make offsets or modifications as required to suit final locations.

3.9 LABELING

A. All HVAC equipment such as pumps, fans, air handling units, and devices requiring identification for operating procedures shall be provided with permanent black laminated micarta white core labels with 3/8 inch letters.

B. This shall also apply to all controllers, remote start/stop pushbuttons and equipment cabinets.

C. This shall not apply to individual room thermostats.

D. All Mechanical Rooms shall be identified with a permanent placard of red-white-red laminated, commercial grade, plastic construction. Letters shall be minimum one inch high and read in capital letters: WARNING – MECHANICAL EQUIPMENT ROOM – LIMITED ACCESS. Placard shall be centered on each door leading into the mechanical room at five feet above the floor and attached at each corner with brass screws.

3.10 ACCESS

A. Locate all equipment, valves, devices and controllers which may need service in accessible places.

B. Maintain access clearances for tube or fan removal, coil pulls, and filter removal.

3.11 WIRING AND MOTOR CONTROLS

A. This Contractor shall furnish all information and assistance required for the Electrical Contractor to purchase all motor starters that are not specified to be part of the mechanical equipment.

B. Control wiring shall be provided under this Division of the work.

C. All wiring shall be in accordance with the National Electrical Code and as recommended by the equipment manufacturer.

3.12 UTILITIES

A. Do not interrupt any utility or service to the Owner without adequate previous notice and schedule.

3.13 CUTTING AND PATCHING EXTERIOR SURFACES

A. This Contractor shall be responsible for returning disturbed paved and/or grass areas to original condition where excavation has been required.

B. Cut and patch paved areas to match original surface.

C. Properly tamp backfill before finishing or repairing disturbed area surfaces.

3.14 OPENINGS - CUTTING, REPAIRING

A. This Contractor shall cooperate with the work to be done under other sections in providing information as to openings required in walls, slabs and footings for all piping, ductwork and equipment, including sleeves where required.

B. Any drilling or cutting required for the performance of work under this Section, shall be the responsibility of this Contractor and the cost thereof shall be borne by him.

C. Holes in Concrete: Sleeves shall be furnished, accurately located and installed in forms before pouring of concrete. This Contractor shall pay all additional costs for cutting of holes as the result of the incorrect location of sleeves. All holes through existing concrete shall be either core drilled or saw cut. All holes required shall have the approval of the Structural Engineer prior to cutting or drilling.

D. It shall be the responsibility of this Contractor to ascertain that all chases and openings are properly located.

3.15 PAINTING

A. The General Contractor shall be responsible for painting.

3.16 GUARANTEE

A. All work shall be guaranteed to be free from defects for a period of one year of operation from date of acceptance by the Owner.

B. Guarantee shall be extended on an equal time basis for all non-operational periods due to failure within the guarantee period.

C. All materials and equipment provided and/or installed under this section of the specifications shall be guaranteed for a period of one year from date of acceptance of the work by the Owner unless otherwise specified in Division 1. Should any trouble develop during this period due to defective materials or faulty workmanship, the Mechanical Contractor shall furnish necessary labor and materials to correct the trouble without any cost to the Owner. Any defective materials or inferior workmanship noticed at time of installation and/or during the guarantee period shall be corrected immediately to the entire satisfaction of the Owner.

D. In the event of occupancy by the Owner prior to final acceptance of the project, the guarantee date for equipment placed in operation shall be mutually agreed to by the Mechanical Contractor and the Owner's representative.

3.17 DRAWINGS

A. The Mechanical Systems are indicated on the Contract Drawings. Certain pertinent information and details required by the Mechanical Work appear on the Architectural, Structural and Electrical Drawings; become familiar with all drawings, and incorporate all pertinent requirements.

B. Drawings are diagrammatic and indicate the general arrangement of systems and requirements of the work. Do not scale drawings. Exact locations of fixtures and equipment, not specifically shown, shall be obtained before starting work.

3.18 TESTING AND BALANCING OF MECHANICAL EQUIPMENT

A. Perform field mechanical balancing in accordance with Section 230950: TESTING AND BALANCING OF MECHANICAL SYSTEMS.

B. The Mechanical Contractor shall own as part of his work, the following:

Provide one (1) additional drive set, if necessary, to obtain final design balancing requirements. The Mechanical Contractor shall coordinate with Balancing Firm and equipment manufacturer for drive selection, including belts and pulleys.

END OF SECTION 230200

SECTION 230210

BASIC MATERIALS AND METHODS - HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.

B. Refer to Section 230200 for HVAC General Provisions.

C. Refer to other sections in Division 23 for materials and methods not specified herein.

1.2 DESCRIPTION OF WORK

A. Included in this Section are the following:

1. Copper Tubing & Fittings
2. Motors

1.3 REFERENCE STANDARDS

A. Refer to Section 230200 for a general description of requirements applying to this section.

B. Install work to meet the requirements of the following:

1. New Castle County Dept. of License and Inspections
2. International Mechanical Code
3. NFPA
4. OSHA
5. ASHRAE
6. Manufacturer’s Standardization Society (MSS) of the valve and Fittings Industry, Inc.:

SP-58 Pipe Hangers and Supports Materials, Design and Manufacture.
SP-69 Pipe Hangers and Supports Selection and Application

C. Appliances and materials governed by UL requirements shall meet such requirements and bear the label.

1.4 QUALITY ASSURANCE

A. Provide adequate supervision of labor force to assure that all aspects of the specifications are being fulfilled.

B. Verify that all work and equipment is installed in accordance with manufacturer's warranty requirements.

PART 2 – PRODUCTS

2.1 COPPER TUBING & FITTINGS

A. Refrigeration Piping:

1. Copper tubing: Type ACR, hard drawn temper.

2. Fitting: Wrought-copper, solder joints, ASME B16.22 or ASME B16.26.

3. Joints: Brazed, American Welding Society (AWS) Class BCUP-5 for brazing filler metal.

B. Condensate Drain Piping:

1. Pipe: Copper tubing Type DWV.

2. Fittings: Wrought copper solder type drainage fittings, ASME B16.23 or B16.29.

2.2 MOTORS

A. All single phase and polyphase motors shall be manufactured to incorporate the latest NEMA standards.

B. All single phase and polyphase motors shall have steel frames with ball bearings and copper windings. All motors to have a Class "F" insulation system with a service factor of 1.15.

C. All motors shall be 1725 RPM, 4 pole design, unless otherwise noted on the drawings, or in the equipment specifications.

D. Motors installed indoors and not exposed to moisture shall be open, dripproof, Class B temperature rise based on 40 deg. C maximum ambient temperature.

E. Motors installed outdoors and exposed to moisture shall be totally enclosed, fan cooled, Class B temperature rise based on 40 deg. C maximum ambient temperature.

F. Based on NEMA Standards, motors shall comply with the following minimum nominal efficiencies at full load.

Nominal Efficiencies for "NEMA Premium ™" Induction Motors
Rated 600 Volts or Less (Random Wound)

	Open Drip-Proof			Totally Enclosed Fan-Cooled		
HP	**3500 RPM**	**1800 RPM**	**1200 RPM**	**3500 RPM**	**1800 RPM**	**1200 RPM**
1	**82.5**	**85.5**	**77.0**	**82.5**	**85.5**	**77.0**
1.5	**86.5**	**86.5**	**84.0**	**87.5**	**86.5**	**84.0**
2	**87.5**	**86.5**	**85.5**	**88.5**	**86.5**	**85.5**
3	**88.5**	**89.5**	**85.5**	**89.5**	**89.5**	**86.5**
5	**89.5**	**89.5**	**86.5**	**89.5**	**89.5**	**88.5**
7.5	**90.2**	**91.0**	**88.5**	**91.0**	**91.7**	**89.5**
10	**91.7**	**91.7**	**89.5**	**91.0**	**91.7**	**90.2**
15	**91.7**	**93.0**	**90.2**	**91.7**	**92.4**	**91.0**
20	**92.4**	**93.0**	**91.0**	**91.7**	**93.0**	**91.0**

G. Motor Characteristics: Refer to Equipment Schedules for specific data.

120/208 Volt System: Motors 1/2HP & Larger - 208V, 3 Phase, 3 Wire
Motors Less than 1/2HP- 120V, 1 Phase, 2 Wire

H. All motors rated less than 1/2HP shall have thermal protection of the auto-reset type as an integral part of the motor.

I. All motors rated 1/2HP and larger shall have thermal protection provided by an external device.

PART 3 – EXECUTION

3.1 PIPING SYSTEMS

A. All piping to drain to low points. Low points shall be provided with drain valves with hose thread.

B. Do not install trapped lines where water cannot be drained or air can accumulate without being vented.

C. Piping shall run square with building lines.

D. Piping shall not be insulated or covered until tested.

E. Necessary drains, off-sets, vents and drips shall be provided for coordination of the work as part of the contract.

F. Running or close nipples are not permitted.

G. Piping shall not be installed over electrical transformers, panels, switchgear, substations, and control panels.

H. Exposed insulated piping risers in unfinished spaces shall be covered with 22 gauge galvanized steel sleeves from floor to ceiling. Refer to Section: Insulation & Covering – HVAC for additional requirements.

I. Allow clearance for expansion and contraction.

J. Install eccentric piping fittings where change in sizes occurs in piping systems. Tops of pipes to remain level.

K. Install isolating fittings between sections of ferrous and non-ferrous pipe or connected equipment.

L. Do not support piping from other piping, conduits or equipment.

M. Material Requirements for Systems:

1. Condensate Drain (including pumped condensate):
   a. Type DWV copper.

2. Refrigerant Piping: Type ACR hard copper.

3.2 TAGS, CHARTS AND IDENTIFICATION

A. See Paragraph "Labeling" in GENERAL PROVISIONS for equipment labeling.

B. Identify each valve in all systems with black, numbered and stamped 1- 1/2" brass or aluminum tags fastened to valve by brass chain and S-hook.

C. Provide 1/8" scale diagrams showing location, number and service or function of each tagged item.

1. Frame diagrams in approved metal frames with clear acrylic front, hinges, and locks.

2. Secure to wall in Mechanical Room.

3. Provide two additional separate copies permanently covered and bound.

   a. Include one (1) copy in the Operation and Maintenance Manuals.

D. Piping Identification: Identify piping with Seton "Setmark" or Brimar, semi-rigid plastic, wraparound pipe markers with flow arrows and conforming to ANSI A13.1. Locate marker at each valve, changes in direction, where pipes pass thru barriers and every 25' of horizontal runs. Lettering on background shall be in accordance with the following colors:

Legend		Background	Lettering
1.	Refrigerant Liquid	- Yellow	- Black
2.	Refrigerant Gas	- Yellow	- Black
3.	Condensate Return	- Yellow	- Black
4.	Pumped Condensate	- Yellow	- Black
5.	Vent	- Yellow	- Black

E. Manufacturers: Seton “Setmark”, Brimar, B-Line MSI.

3.3 SOLDERING/BRAZING

A. Connections between copper tubing and copper fittings shall be made with the appropriate filler metal. Flux shall be non-corrosive type as recommended by the manufacturer of the filler metal, and conforming to AWS A5.8.

B. Tubing shall be cut square and then reamed and deburred. End of tubing and inside of fitting cup shall be cleaned with steel wool and the flux shall be applied to the clean surface before joining. After joining, the excess filler metal shall be wiped off while still plastic.

C. Silver brazing alloy shall be equal to Easy-Flo by Handy and Harmon or Sta-Brite silver solder and shall be used for joints in:

1. Air conditioning drain piping

D. Where the silver brazing is performed in a confined non-ventilated space, a non-toxic, cadmium-free brazing alloy such as braze 560 by Handy & Harman shall be used.

E. Refrigerant piping shall be silver brazed using Harris Sil-Fos 15 or equivalent, with nitrogen purge.

F. Bring joint to solder temperature or brazing temperature in as short a time as possible.

G. Form continuous solder bead or brazing filler bead around entire circumference of joint.

H. Wipe excess solder from joint area while solder is still plastic.

END OF SECTION 230210

SECTION 230215

VALVES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.

B. Refer to Section 230200 for HVAC General Provisions.

C. Refer to other sections in Division 23 for materials and methods not specified herein.

1.2 DESCRIPTION OF WORK

A. This Section includes the following:

1. General
2. Refrigerant Valves and Specialties

1.3 QUALITY ASSURANCE

A. Provide adequate supervision of labor force to assure that all aspects of the specifications are being fulfilled.

B. Verify that all work and equipment is installed in accordance with manufacturer's warranty requirements.

PART 2 – PRODUCTS

2.1 GENERAL

A. All valves shall be designed with packing suitable for the intended service. When the valve is fully opened, the back seat shall protect the packing and the stem threads from the fluid. The pressure-temperature rating of valves shall be not less than the design criteria applicable to all components of the system.

B. Insofar as possible, all valves of the same type shall be of the same manufacture.

C. All valves shall be provided with stem extensions. Valve handle shall be clear of insulation jacket.

2.2 REFRIGERANT VALVES & SPECIALTIES

A. Service Valves:

1. Globe Shutoff Valves: Forged brass, packed, back seating, winged seal cap, 300 degrees F (149 degrees C) temperature rating, 500 psi working pressure.

2. Check Valves: Forged brass, accessible internal parts, soft synthetic seat, fully guided brass piston and stainless steel spring, 250 degrees F (121 degrees C) temperature rating, 500 psi working pressure.

3. Manufacturers:

   Henry Valve Co.
   Parker Hannifin Corp., Refrigeration & Air-Conditioning
   Sporlan Valve Co.

B. Solenoid Valves:

1. 2-way Solenoid Valves: Forged brass, designed to conform to ARI 760, normally closed, teflon valve seat, NEMA 1 solenoid enclosure, 24-volt, 60 Hz., UL-listed, 1/2" conduit adapter, 250 degrees F (121 degrees C) temperature rating, 400 psi working pressure.

2. Manufacturers:

   Alco Controls Div., Emerson Electric Co.
   Automatic Switch Co.
   Sporland Valve Co.

C. Specialties:

1. Refrigerant Strainers: Brass shell and end connections, brazed joints, monel screen, 100 mesh, UL listed, 350 psi working pressure.

2. Moisture-Liquid Indicators: Forged brass, single port, removable cap, polished optical glass, solder connections, UL listed, 200 degrees F (93 degrees C) temperature rating, 500 psi working pressure.

3. Refrigerant Filter-Driers: Steel shell, ceramic fired desiccant core, solder connections, UL listed, 500 psi working pressure.

4. Evaporator Pressure Regulators: Provide corrosion-resistant, spring loaded, stainless steel springs, pressure operated, evaporator pressure regulator, in size and working pressure indicated, with copper connections.

5. Refrigerant Discharge Line Mufflers: Provide discharge line mufflers as recommended by equipment manufacturer for use in service indicated, UL listed.

6. Manufacturers:

   Alco Controls Div., Emerson Electric Co.
   Henry Valve Co.
   Parker-Hannifin corp., Refrigeration & Air Conditioning Div.
   Sporlan Valve Co.

PART 3 – EXECUTION

3.1 PIPING SYSTEMS

A. Valve body construction shall match piping system material.

B. Install isolating fittings between sections of ferrous and non-ferrous pipe or connected equipment.

C. Valves shall be installed with stems above horizontal.

D. Valves shall be installed on all sides of equipment and control valves to allow isolation for repair.

3.2 TAGS, CHARTS AND IDENTIFICATION

A. Identify each valve in all systems in accordance with requirements of Section 230210.

END OF SECTION 230215

SECTION 230230

INSULATION & COVERING - HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.

B. Refer to Section 230200 for HVAC General Provisions

C. Refer to Section 230210 for HVAC Basic Materials & Methods.

1.2 DESCRIPTION OF WORK

A. This Section includes insulation and covering provided on the following piping and equipment:

1. Condensate Drain Lines
2. Refrigerant Piping.
3. Exterior Piping
4. Acoustic Duct Liner

1.3 REFERENCE STANDARDS

A. Refer to Section 230200 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

A. Refer to Section 230210 for a general description of requirements applying to this section.

B. Install insulation in accordance with manufacturer's recommendations.

C. Provide adequate supervision of labor force to assure that all aspects of the specifications are being fulfilled.

1.5 SUBMITTALS

A. Submit shop drawings, installation instructions, and manufacturer's literature of all materials specified in accordance with Section 230200.

B. Submit fabrication instructions for pipe fitting and valve insulation.

C. Submit manufacturer's joining recommendations for butt joints and longitudinal seams.

1.6 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements.

PART 2 – PRODUCTS

2.1 PIPE INSULATION MATERIAL

A. Fiberglass:

1. Material: Preformed fiberglass bonded with resin to form circular pipe sleeves with factory applied, white all service jacket bonded to reinforced foil vapor barrier jacketing. The jacket shall have factory applied double pressure-sensitive, self-sealing, adhesive closure and vapor sealing of longitudinal joints. Thermal conductivity: 0.24 Btu/Hr./SF/inch at 100 degrees F. Flame spread of 25 and developed smoke of 50 or less.

2. All Valves and Fittings:

   a. Glass fiber insert and premolded PVC cover, Johns Manville Corp. "Zeston" and "Hi-Lo Temp Inserts" for fittings. Glass fiber must fill the entire space within the cover completely.

   b. Factory molded fibrous glass fitting covering for fittings. Coat ends with Fosters 30-36 lagfast adhesive

   c. Mitered sections of pipe covering for valves.

3. Manufacturers: Johns Manville Corp., Certain-Teed, Owens- Corning, Knauf.

B. Closed Cell:

1. Material: Flexible elastomeric foamed plastic closed cell structure insulation 25/50 rated with a flame spread rating of 25 or less and a smoke developed rating of 50 or less.

2. Flexible pipe insulation shall be a foamed plastic closed cell structure material, with a thermal conductivity of not more than 0.27 Btu/Hr./Sq. Ft./Inch at a mean temperature of 75 degrees F. The insulation shall have an average density of at least 2 pounds per cubic foot, shall be self-extinguishing, and shall have a water vapor transmission rating of not more than 0.1 perms. Between temperature limits of -40 degrees F and plus 220 degrees F, the insulation shall not indicate any deviation from its original state.

3. Specification Compliance:

   ASTM-E-84
   ASTM-C-534 Type I – Tubular, Type II – Sheet.
   ASTM-D-1056, 2B1 – Tubular, Sheet.
   MIL-C-3133B (MIL STD 670B) Grade SBE-3
   MIL-P-15280J, Form T, Form S.

4. Manufacturers: Armacell, Nomaco K-Flex, Halstead.

C. Covering of Pipe Insulation Outdoors:

1. Wrapping: Wrap insulation with embossed 0.016" aluminum jacket.

2. Fastenings: Cover shall be held in place with soft aluminum bands on 12" centers.

3. Valves and Fittings: Weatherproof all valves and fittings.

D. Manufacturers: Johns Manville Corp.., Certain-Teed, Owens- Corning, Knauf.

2.2 ACOUSTIC DUCT LINER

A. Duct liner shall be designed for use as an acoustical insulation to absorb air conditioning noise in sheet metal ducts and plenums operating at velocities up to 6000 fpm and temperatures up to 250 deg. F.

B. Duct liner shall be a bonded mat of glass fibers coated with an EPA registered biocide and a black pigmented fire-resistant coating on the air stream side.

C. Duct liner shall comply with the requirements of NFPA 90A and 90B. Surface burning characteristics shall comply with UL Standard 723 for 25/50 flame and smoke development.

D. Duct liner shall comply with the property requirements of ASTM Specification C1071 Type 1. Material shall resist fungal and bacterial growth when subjected to ASTM G21 and G22 test methods.

E. Material thickness, name of manufacturer and type shall be printed on the air stream side of the liner for ease of identification.

F. Duct liner shall be 2” thick, unless otherwise noted on the drawings.

G. Manufacturers: Owens Corning QuietR® AcousticR™ Duct Liner, Certainteed, Evonik Industries Solcoustic, Johns Manville Linacoustic® RC.

PART 3 – EXECUTION

3.1 INSTALLATION - GENERAL

A. Do not install until systems have been tested and meet requirements.

B. Heavy work which may damage insulation shall have been completed in the vicinity of the insulation work.

C. Provide non-compressible insulation saddles at all piping hanger locations, and at all piping hanger locations where piping is insulated with flexible closed cell insulation.

Option: Provide insulation coupling system as made by Klo-Shure Co.

D. All installations shall be made by skilled craftsmen regularly engaged in this type of work.

E. Insulation shall be continuous thru-wall, ceiling and floors.

F. Metal shields, 16 gauge galvanized, shall be installed between hangers and pipe insulation.

G. Pipe shall be clean and dry prior to insulating.

H. Install all insulation per manufacturer's instructions.

I. To avoid undue compression of insulation, provide solid core inserts at all supports as recommended by the insulation manufacturer. Provide insulation shields between the insulation jacket and the hanger.

J. Ductwork treated with internal acoustic duct liner does not require external insulation.

3.2 PIPE INSULATION - TYPES & THICKNESSES

A. Provide fiberglass insulation of thickness specified on:

1. Refrigerant Piping: Interior locations, exposed and concealed for suction lines. (NOTE: Insulate liquid line if metering device is mounted at the condensing unit.)

   1-1/2" thick.

B. Provide flexible closed cell insulation of thickness specified on:

1. Refrigerant Piping: Exterior Locations for suction lines. (NOTE: Insulate liquid line if metering device is mounted at the condensing unit.)

   1-1/2" thick.

2. 1/2" thickness for condensate drain lines.

3.3 EXTERIOR PIPE COVERING

A. Wrapping: Wrap insulation with embossed 0.016" aluminum jacket, orient seam down.

B. Fastenings: Cover shall be held in place with soft aluminum bands on 12" centers.

C. Valves and Fittings:

1. Weatherproof all valves and fittings.
2. Finish: Apply two coats of vapor resistant mastic reinforced with glass fabric over wrapping.

3.4 INTERIOR PIPE COVERING

A. Provide premolded PVC cover on all interior insulated piping exposed in finished spaces. Orient seams up in overhead piping and toward the wall in vertical runs.

B. Provide factory molded fitting covering for fittings and accessories, sealed and held in place by manufacturer’s recommended sealing system.

C. Provide mitered sections of covering for valves.

3.5 ACOUSTIC DUCT LINER

A. All portions of duct designated on the drawings to receive duct liner shall be completely covered with duct liner, adhered to the sheet metal with a 100% coverage of adhesive complying with ASTM C916.

B. Transverse joints shall be neatly butted and there shall be no interruptions or gaps. All transverse joints and all exposed leading edges shall be coated. The black coated surface of the duct liner shall face the airstream.

C. Duct liner shall be secured with mechanical fasteners which shall compress the duct liner sufficiently to hold it firmly in place.

D. Duct liner shall be cut to assure overlapped and compressed longitudinal joints.

E. After installation is complete, blow out the duct system prior to operation to remove any cutting scraps and foreign material remaining in the duct.

END OF SECTION 230230

SECTION 230450

REFRIGERATION EQUIPMENT - HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.

B. Refer to Section 230200 for HVAC General Provisions

C. Refer to Section 230210 for HVAC Basic Materials & Methods.

D. Refer to Section 230760 for Air Handling Equipment.

1.2 DESCRIPTION OF WORK

A. This Section includes labor, material, equipment and supervision to for the following:

1. Condensing Unit (10 to 20 Tons)

B. Provide complete refrigeration system including chillers, cooling towers, underground pre-insulated pre-fabricated piping, aboveground piping and all required accessories.

1.3 REFERENCE STANDARDS

A. Refer to Section 230200 for a general description of requirements applying to this section.

B. Comply with applicable provisions of:

1. International Mechanical Code
2. ASME Codes for Pressure Vessels
3. A.R.I. Capacity Ratings
4. NFPA Pamphlets
5. ASHRAE Standard 15
6. ASHRAE Standard 90.1, Section 6, Table 6.8.1A thru J, minimum equipment efficiency.

1.4 QUALITY ASSURANCE

A. Refer to Section 230210 for a general description of requirements applying to this Section.

1.5 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 230200.

B. Submit the following:

1. Shop drawings and product data for all equipment in this section.
2. 1/4" = 1'-0" scale layout of all equipment in Mechanical Areas.

1.6 SUBSTITUTIONS

A. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, this Contractor shall be responsible for any and all additional costs associated with the changes required by other trades.

1.7 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements. In addition, the following special guarantee applies:

1. Manufacturer shall guarantee all refrigeration equipment including parts and labor, for five (5) years from start-up.

PART 2 – PRODUCTS

2.1 CONDENSING UNIT (10-20 Tons)

A. General:

1. Furnish air-cooled condensing unit in accordance with the performance schedule shown on the plans.

2. Install them as shown on the plans in accordance with:

   - The manufacturer's recommendations and
   - All applicable national and local codes.

3. UL (CSA) approved.

4. Completely assembled for one-piece shipping and rigging.

5. Leak, pressure and functionally tested at the factory to assure a trouble-free start-up after installation.

6. In current production with published literature available to check performance, limitations, specifications, power requirements, dimensions, operation and appearance.

B. Unit Enclosure:

1. A steel angle frame to provide the rigid support required for shipping, rigging and years of dependable operation.

2. Exterior panels of 18-gauge galvanized sheet steel which have been bonderized and finished with baked enamel to provide a long-lasting quality appearance.

3. Removable panels to provide easy access to all internal components for maintenance, service and adjustment.

C. Each compressor shall be mounted on spring isolators and shall be enclosed in a separate compartment to minimize the transmission of sound and vibration.

D. Condenser Coils:

1. Shall be draw-thru, with manufacturer's standard wire guards.

2. Shall be constructed of copper tubes arranged in staggered rows and mechanically expanded into aluminum fins, and

3. Shall have a separate circuit which will provide at least 19 degrees F of liquid sub-cooling at design conditions.

E. Condenser Fan Motors:

1. Shall be directly connected to the condenser fans,

2. Shall have permanently lubricated ball bearings, and

3. Shall have inherent overload protection.

4. Motors shall be of the permanent split-capacitor type.

5. Condenser fans shall be arranged for vertical discharge of the condenser air, with manufacturer's standard wire guards.

F. The wiring for each unit shall include:

1. A crankcase heater (one per compressor).

2. A 24-volt temperature control circuit.

3. High and low pressure circuits.

4. Condenser fan motor controls to assure stable operation of ambient temperatures down to 0 degrees F.

5. Condenser fan and compressor contactors factory wired to pressure lugs or terminal block for power wiring.

G. The refrigerant piping for each system shall include:

1. A strainer-drier. The strainer-drier and sight glass may be shipped separately for field installation.

2. A moisture indicating sight glass.

3. Service access valves.

4. Hot gas bypass kit for field installation.

H. Manufacturers: same as Air Handling Unit.

PART 3 – EXECUTION

3.1 REFRIGERATION EQUIPMENT

A. All equipment to be installed in accordance with manufacturer's recommendations. Unit shall be properly.

B. Provide pipe insulation and jacketing over all exterior piping.

C. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements. Do not proceed with equipment start-up until wiring installation is acceptable.

D. Manufacturer's Field Services

1. Manufacturer shall furnish a factory trained service engineer without additional charge to start the unit(s). Representatives shall provide leak testing, evacuation, dehydration, and charging of the unit(s) as required. Manufacturer shall maintain service capabilities to promptly respond within 24 hours or less to service calls at the site.

2. A start-up log shall be furnished by the manufacturer to document start-up date and shall be signed by the owner or his authorized representative prior to commissioning.

3. The manufacturer shall furnish complete submittal wiring diagrams for all associated components, interlocks, etc. as applicable.

3.2 FIELD QUALITY CONTROL

A. Start-up all units in accordance with manufacturer's start-up instructions. Replace damaged or malfunctioning controls and equipment.

END OF SECTION 230450

SECTION 230600

AIR DISTRIBUTION & ACCESSORIES - HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.

B. Refer to Section 230200 for HVAC General Provisions

C. Refer to Section 230210 for HVAC Basic Materials & Methods.

D. This Contractor shall coordinate with the work of Division 26 and the Fire Alarm System vendor for locations and mounting of all duct smoke detectors. These devices are shown on the Mechanical Drawings for reference only to show the intent of the work. All locations shall be determined based on approved shop drawings from the Fire Alarm System vendor and the Contractor for the work of Division 26, Electrical. Mount smoke detectors in the supply and return air stream at each unit in accordance with NFPA 72.

1.2 DESCRIPTION OF WORK

A. This Section includes labor, material, equipment and supervision to provide a complete air distribution system as specified herein and as shown on drawings.

1. Ductwork – Single Wall, Square and Rectangular
2. Air Registers and Grilles

1.3 REFERENCE STANDARDS

A. Refer to Section 230200 for a general description of requirements applying to this section.

B. Requirements established within the portions of the Project Manual titled Division 1, General Requirements, are collectively applicable to the work of this section.

C. IMC (International Mechanical Code).

D. SMACNA (Sheet Metal and Air Conditioning Contractors National Association, Inc.)

E. American Society of Heating, Refrigerating and Air Conditioning Engineers' recommendations in ASHRAE Guide shall apply to this work.

F. ARI Standard 885 - Standard for Estimating Occupied Sound Levels in the Applications of Air Terminals and Air Outlets.

G. UL (Underwriter's Laboratories, Inc.)

H. NFPA 90A shall apply to this work.

I. State Fire Prevention Regulations.

1.4 QUALITY ASSURANCE

A. Refer to Section 230210 for a general description of requirements applying to this Section.

1.5 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 230200.

B. Submit the following:

1. Shop drawings of all sheet metal.

2. Manufacturer's literature and performance data of all equipment and devices.

3. Samples: Furnish color samples, etc., at request of the Architect.

1.6 SUBSTITUTIONS

A. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but shall not be limited to space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, they shall be responsible for any and all additional costs associated with the changes required by other trades.

1.7 WARRANTY GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements.

PART 2 – PRODUCTS

2.1 DUCTWORK (SINGLE WALL, SQUARE AND RECTANGULAR)

A. All ductwork shall be fabricated in accordance with SMACNA "HVAC Duct Construction Standards - Metal and Flexible" latest Edition except as described below. The minimum thickness of metal ductwork is 26 gauge. Fabrication requirements shall be based on ductwork subjected to positive or negative pressures of 4” W.G. Ductwork systems shall be sealed to SMACNA "Seal Class “A” Standards. Alternatively, "Ductmate" System 45 can be used in accordance with manufacturer's specifications. Drive slip joints are not permitted.

B. Rectangular ducts for 4” W.G. or less, positive or negative pressure shall be per SMACNA Table 1-7. Longitudinal seams shall be Pittsburgh Lock Type L-l per SMACNA Figure 1-5. Transverse joints shall be standing seam type T -15 per Figure 1-4.

1. In the event that material size is not compatible with duct size and segmenting must be utilized to fabricate duct, use SMACNA Figure 1-5, seam L-4 (Standing Seam).

C. Joints:

1. Per SMACNA Transverse Joint Reinforcement Table 1-12, only joints T -22, T -25a, T -25b and Proprietary slip on flanges will be acceptable.

2. Joints T -25a and T -25b that have stress fractures from bending will not be accepted.

3. All joints will have butyl gasket 3/16" thick by 5/8" wide installed per manufacturers installation instructions.

D. Ductwork systems for this standard shall be galvanized sheet steel, commercial quality of lock - forming grade, conforming to ASTM coating standards A-525 or A-527 with coating of designation G-60.

1. Where the outer surface of the duct is exposed in finished spaces and is not scheduled for insulation, duct material shall be galvannealed, suitable for field painting by the General Contractor.

E. The size and configuration of each duct shall be indicated on design drawings. Where thicker sheets or different types of materials are required, they shall be specified on the design drawings or in the project specifications.

2.2 AIR REGISTERS AND GRILLES

A. Air terminals shall be provided in duct runs on drawings. The air terminals shall properly and uniformly distribute the design air quantity with no objectionable drafts, while maintaining not more than 50 F. P. M. velocity in the occupied portion of the space.

B. Registers & Grilles:

1. Registers and grilles shall be steel construction, double deflection type, with clips and/or flange holes and screws to secure registers to plenum. Registers and grilles shall be factory primed and painted with a baked-on white enamel finish.

2. Supply Grilles (SG):

a. Grilles shall be available parallel to the long dimension of the grille. Construction shall be of steel with a 11/4-inch wide border on all sides. Screw holes shall be countersunk for a neat appearance. Corners shall be welded with full penetration resistance welds.

b. Deflection blades shall be firmly held in place by mullions from behind the grille and fixed to the grille by welding in place. Blade deflection angle shall be available at 35°.

c. The finish shall be #26 white. The finish shall be a baked on anodic acrylic paint, with a pencil hardness of HB to H.

d. Titus model: 300 RL (SG)

D. Manufacturers: Provide registers and grilles of one of the following:

Anemostat	Price
Carnes Co.	Titus
Kruger	Tuttle & Bailey
Metalaire	Nailor Industries

PART 3 – EXECUTION

3.1 DUCTWORK

A. Dimensions on drawings are inside dimensions. Sheet metal dimensions shall be increased to suit thickness of acoustic duct lining, if applicable. Ductwork that is lined with acoustic lining is not insulated.

B. Supports shall be galvanized steel.

C. Do not install ductwork directly above any electrical equipment.

D. Ductwork shall be supported per SMACNA Standards except as follows:

1. Rivet or screw to side of duct when using flat strap hangers. Rivet or screw to bottom of duct when using trapeze hangers.

2. Extend hangers down the side of the duct at least 9"; pass hangers under ducts less than 9" deep.

3. Space hangers not more than 8' on centers for ducts up to 18" wide and 4' on centers for ducts over 18" wide.

4. Wire hangers are not acceptable.

5. Support ductwork from building structure with expansion bolts, rods, steel angles or channels installed to meet existing or new building conditions.

6. Drilling into the roof deck is not permitted.

7. Driving nails into anchors is not permitted.

3.2 DUCT SYSTEM LEAK SEALING

A. Joints in duct systems at duct heaters, air monitors, fire dampers, sound traps, supply air terminals including air handling light fixtures, shall be sealed to prevent air leakage.

B. All duct joints and seams in medium pressure and high pressure duct systems shall be sealed to SMACNA Seal Class" A" Standards to prevent air leakage.

C. In the event there is in excess of 5% air leakage indicated in low pressure duct systems, it shall be the Contractors responsibility to seal the duct system. The amount of sealing necessary shall be that required to obtain the design air quantity at each terminal.

D. Duct sealing shall be by means of high velocity duct sealants such as Hardcast and/or Neoprene gaskets. Type of sealant and method of application shall conform to recommendations in SMACNA high velocity duct construction standards.

END OF SECTION 230600

SECTION 230760

AIR HANDLING EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.

B. Refer to Section 230200 for HVAC General Provisions

C. Refer to Section 230210 for HVAC Basic Materials & Methods.

D. Refer to Section 230450 for Refrigeration Equipment – HVAC.

1.2 DESCRIPTION OF WORK

A. This Section includes work necessary and/or required and materials and equipment for construction of a complete system. Such work includes, but is not limited to the following:

1. Air Handling Units (Modular, Sectional Type)

1.3 REFERENCE STANDARDS

A. Refer to Section 230200 for a general description of requirements applying to this section.

B. AMCA Standards 210 and 300 for fans.

C. ARI Standard 410, ASHRAE Standard 33 for Heating and Cooling Coils.

D. ASHRAE Standard 52.2 and U.L. Standard 900 for media type air filters.

E. ARI Standard 260 and 430 for Air Handling Units.

1.4 QUALITY ASSURANCE

A. Refer to Section 230210 for a general description of requirements applying to this Section.

1.5 SUBMITTALS

A. Submit shop drawings in accordance with Section 230200.

B. Submit shop drawings and descriptive date for all equipment specified in this section.

1.6 SUBSTITUTIONS

A. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but not limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items provided by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, this Contractor shall be responsible for any and all additional costs associated with the changes required by other trades.

1.7 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements.

PART 2 – PRODUCTS

2.1 AIR HANDLING UNITS (MODULAR, SECTIONAL TYPE)

A. The air handling units for central station air conditioning shall be sectional component type. Components shall include fan section, cooling coil section, drain pan, double wall construction, filter box and air filters.

1. All segments shall be double wall construction and shall be constructed of G90 mill galvanized sheet steel, formed and reinforced to provide a rigid assembly.

2. The exterior casing shall be constructed of minimum 18-gauge galvanized steel.

3. The interior lining shall be a perforated lining of a minimum of 20 gauge. Units with double wall construction must have a full 2" (non-compressed) insulation throughout the entire unit.

4. All panels shall be insulated with 2" – 1.5# fiberglass insulation. The insulation shall meet the flame and smoke generation requirements of NFPA-90A.

5. All panels shall be completely gasketed prior to shipment with a minimum of ¼" thick and ¾" wide closed cell neoprene.

6. All access panels shall be completely removable for unit access and removal of components. All access panels must be removable without the use of electricity or compressed air. Panels will be removable with a hex wrench, or built-in latching handle.

7. Double wall access doors shall be provided in the fan and filter segments on the motor side of the unit. Access doors must also be provided in all segments where the removal of sheet metal screws is required for unit access.

   Doors shall be of the same thickness and construction as the wall panels. A bulb-type gasket shall be provided around the entire door perimeter. Industrial style hinges shall permit a complete 180 degree door swing. A door stop will be provided on all positive pressure doors.

8. The exterior of the unit shall be completely cleaned prior to application of finished coats. A prime coat of epoxy chromate shall be applied to a minimum thickness 1.5 mils.

B. The fan section shall consist of a rectangular steel cabinet, incorporating single or multiple centrifugal fans mounted on a cold rolled steel shaft which shall rotate in grease lubricated ball bearings. The fans shall be multi-blade forward, backward inclined or air foil as required by operating conditions shown in schedules. Fan ratings shall be based on AMCA Standards 210 and 300. Fans shall bear the AMCA seal.

1. Fan and fan motor shall be internally mounted and isolated on a full width isolator support channel using 1" springs. The fan discharge shall be connected to the fan cabinet using a flexible connection to ensure vibration-free operation. The isolator support rail shall be structurally supported from the unit base.

2. Fan motors shall be NEMA design ball bearing type with electrical characteristics and horsepower as specified on the schedule. Motors shall be 1750 RPM, open dripproof type. All motors shall be high efficiency.

3. The motor shall be mounted on the same isolation base as the fan. The motor shall be on an adjustable base.

4. Fan bearings shall be self-aligning, pillow block or flanged type regreaseable ball bearings and shall be designed for an average life (AFBMA L50) of at least 200,000 hours. All bearings shall be factory lubricated and equipped with standard hydraulic grease fittings and lube lines extended to the motor side of the fan.

5. Fan drives shall be selected for a 1.5 service factor and anti-static belts shall be furnished. All drives shall be adjustable pitch.

6. Fan shafts shall be selected to operate well below the first critical speed and each shaft shall be factory coated after assembly with an anticorrosion coating.

C. The fan shaft shall be motor driven through a Vee-belt drive. The drive assembly shall be designed for not less than 150% of the motor ampere rating. Adjustment of belt tension shall be by means of an adjustable motor base. The drive assembly shall conform to A.R.I. Standard 435-78. The drive sheave shall be variable pitch type where it falls between limits of A.R.I. Standard 435-78. Outside the established limits, an initial and a final set of fixed drives shall be required. Fan motors shall have copper windings.

D. Heat transfer coils shall be non-ferrous tube-in-fin type. The tubes shall be seamless copper with a wall thickness not less than 0.024 inch. The fins shall be rectangular plate type of aluminum with a thickness of not less than 0.009 inch. The tube openings in the fins shall be die-formed to provide a spacing collar between adjacent fins. The tubes shall be mechanically expanded with the fins to form a tight permanent mechanical joint. The tubes shall be silver-alloy brazed into heavy wall thickness copper or brass tubular headers.

1. All coils shall be installed on tracks for easy removal from the air handling unit. Units that require disassembly of the unit for coil removal are not acceptable.

2. Coil casing to be constructed of 16-gauge galvanized steel. Intermediate casing supports shall be supplied for finned lengths that exceed 60".

3. The primary surface shall be ½" O.D. copper tube, staggered in direction of air flow. Tubes shall be mandrel expanded to form fin bond and provide burnished, work-hardened interior surface.

4. Extended surface shall consist of die-formed, continuous, aluminum fins. The fins shall have fully drawn collars to accurately space fins, and to form a protective sheath for the primary surface.

5. Headers shall be of heavy seamless copper tubing, silver-brazed to tubes. Connections shall be of red brass, with male pipe threads, silver-brazed to the headers.

6. Coil grommets shall be provided on all coils to completely seal the area between the coil connection and the unit casing.

E. The cooling coil section shall be provided with an extra heavy gauge drain pan sloping to drain outlets. The drain pan shall be insulated and finished or coated with waterproof and rust resistant material.

F. Air filters shall be 2 inches thick arranged in modular sized to be readily removable through a hinged access door. Air filters shall be throwaway type.

1. Flat pre-filter segments shall accommodate 2" media. MERV 8 per ASHRAE Standard 52.2-99.

2. The filter frames shall be constructed of galvanized steel and be built as an integral part of the unit. All filter segments shall be side service with an access door on the drive side of the unit.

3. A magnahelic differential pressure gauge shall be factory installed and flush mounted on drive side to measure the pressure drop across the prefilter and high efficiency filters.

4. Manufacturer: Manufacturer's Standard.

J. The exterior and interior of the casing shall receive a rust and corrosion resistant finish.

K. Air handling unit shall be provided with a full perimeter 6" base rail to support unit.

L. The air conditioning units shall be manufactured by: American Air Filter, Carrier Corporation, Trane Company, York/Johnson Controls.

1. Any listed equivalent manufacturer and the Mechanical Contractor shall be completely responsible to comply with all requirements on the contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

B. Install in accordance with manufacturer's recommendations. Unit and all component sections shall be properly supported and vibration isolated.

3.2 INSTALLATION

A. Verify that coils, filters, motors, drives and other components are matched with the proper unit.

B. Assemble unit components following manufacturer's instructions for handling, testing and operation. Repair damaged galvanized areas, and paint in accordance with manufacturer's written recommendations.

C. Vacuum clean interior of units prior to operation.

D. Repair air leaks from or into casing that can be heard or felt during normal operation.

E. Perform field mechanical balancing in accordance with Section 230950: TESTING AND BALANCING OF MECHANICAL SYSTEMS.

F. The Mechanical Contractor shall own as part of his work, the following:

Provide one (1) additional drive set, if necessary, to obtain final design balancing requirements. The Mechanical Contractor shall coordinate with Balancing Firm and equipment manufacturer for drive selection, including belts and pulleys.

END OF SECTION 230760

SECTION 230900

AUTOMATIC TEMPERATURE CONTROL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Section 230200 and drawings are hereby made a part of this section as fully as if repeated herein.

B. The Mechanical Contractor shall coordinate with the work of Division 26 and the Fire Alarm System vendor for locations and mounting of all duct smoke detectors. These devices are shown on the Mechanical Drawings for reference only to show the intent of the work. All locations shall be determined based on approved shop drawings from the Fire Alarm System vendor and the Contractor for the work of Division 26, Electrical.

1.2 DESCRIPTION OF WORK

A. Provide labor, material and supervision necessary to install a complete direct digital control system of temperature controls to control all HVAC Systems, associated components and accessories as described herein, as an extension of the existing Johnson Metasys System.

1.3 SUBMITTALS

A. Submit shop drawings and manufacturer's data sheets of all equipment.

B. Submit manufacturer's certificates of conformance with applicable codes.

C. Furnish point-to-point diagram of automatic temperature control system approval, including heating, ventilating and air conditioning equipment wiring diagrams where temperature control connections are required.

D. Provide ten (10) copies of submittal data within thirty (30) days of contract award.

E. Submittal shall consist of:

1. System Architecture showing all digital and pneumatically actuated devices.

2. Equipment lists of all proposed devices and equipment including data sheets of all products.

3. Valve, damper and well and tap schedules showing size, configuration, capacity and location of all equipment.

4. Data entry forms for initial parameters. Contractor shall provide English listing of all analog points with columnar blanks for high and low warning limits and high and low alarm limits, and a listing of all fan systems with columnar blanks for beginning and end of occupancy periods; and samples of proposed text for points and messages (for at least two systems of at least 15 points total) including sample 480 character alarm message. All text shall be approved prior to data entry.

5. Wiring and piping interconnection diagrams including panel and device power and sources.

6. Sketches of all graphics.

1.4 QUALITY ASSURANCE

A. Insure that all work and equipment is installed in accordance with manufacturer's warranty requirements.

B. Provide adequate supervision of labor force to assure that all aspects of specifications are being fulfilled.

C. The system shall be engineered, programmed and installed by personnel trained and regularly employed by the control's manufacturer.

D. Supplier shall have technical support to promptly respond within 24 hours or less to service calls to the site with technical staff, spare parts inventory and test and diagnostic equipment.

E. Codes and Approvals:

1. The complete system installation shall be in strict accordance with national and local electrical codes. All devices designed for or used in line voltage applications shall be UL listed.

   a. All microprocessor based devices shall be UL916 listed.

   b. All electrical environmental control and monitoring devices shall be UL429 and/or UL873 listed.

2. All electronic equipment shall conform to the requirements of FCC regulation Class B, Part 15, Section 15 governing radio frequency electromagnetic interference and be so labeled.

3. The complete system shall conform to ANSI/ASHRAE Standard 135.95, BACNET.

F. All system components shall be designed and built to be fault tolerant.

1. Provide satisfactory operation without damage at 100% above and 85% below rated voltage and at +3 Hertz variation in line frequency.

2. Provide static, transient, and short circuit protection on all inputs and outputs. Communication lines shall be protected against incorrect wiring, static transients and induced magnetic interference. Bus connected devices shall be A.C. coupled or equivalent so that any single device failure will not disrupt or halt bus communication.

1.5 ELECTRICAL WIRING

A. All electrical wiring, components and accessories in connection with the Automatic Temperature Control System shall be furnished and installed by the control manufacturer.

1. Electrical Contractor shall provide all wiring to duct smoke detectors.

2. Unless stated otherwise in the design documents, the ATC Contractor is responsible for providing control power to all valves, actuators, devices and components within the DDC System

regardless of the selected voltage of those devices. This also includes all 120 volt power circuits required for devices, panels and control equipment.

B. Control wiring shall include all wiring necessary to interface with new controls, such as relays and transducers, and shall also include electric and electronic devices such as freezestats, electronic sensors, relays, flow switches and controlled devices, both electric/electronic actuated devices. Pilot devices such as ON/OFF switches and thermostats installed in series with line voltage circuits shall be considered to be control wiring.

1.6 AUTOMATIC TEMPERATURE CONTROL

A. Provide a DDC System of automatic temperature control which shall be as manufactured by Johnson Controls, Inc., as installed by Modern Controls, Inc. The system shall be complete in all respects including labor, materials, equipment and services necessary.

B. All electrical wiring in connection with the installation of the automatic temperature control system shall be furnished and installed under the direct supervision of the control manufacturer.

PART 2 – PRODUCTS

2.1 SENSORS

A. Solid state room sensors shall be of the wire wound resistance type element. Sensors shall be equipped with visual readout and adjustment. Sensors shall be of the completely solid state type with no moving contacts. Printed circuit board under thermostat cover shall contain a low mass resistance type setpoint dial and amplifier. Provide test points for measuring output voltage. Sensors shall be direct or reverse acting as required for the sequence of operation.

2.2 SMOKE DETECTORS

A. Duct type ionization smoke detectors shall be furnished by the Electrical Contractor and installed by the Mechanical Contractor in the supply and return air stream. The Electrical Contractor shall provide wiring from each detector to the Fire Alarm System panel.

B. The Electrical Contractor shall provide an alarm output signal from the FAS panel to the BAS for unit shutdown.

2.3 SENSOR TRANSMITTERS

A. Duct and immersion sensors shall have minimum spans as required to meet the temperature requirements. Duct sensors shall have sensing elements of sufficient length and accuracy to measure average duct temperature in each location.

B. Sensors shall be of corrosion resistant construction, tamperproof, suitable for mounting on a vibrating surface. Exposed capillaries shall be temperature compensated, and armored or installed in protective tubing.

C. All sensing elements for water pipe mounting shall be of the rod and tube type with linear output and shall be furnished complete with separable protecting wells filled with heat conductive compound. Sensors shall be factory calibrated and tamperproof. If easily adjustable sensors are provided, they

shall be located inside metal enclosures with cylinder lock and key to prevent unauthorized setting.

D. Safety Devices: Provide the following:

1. Air duty flow switches: Current sensor type for fan status.

2.4 CONTROL CABINETS

A. Control cabinets shall be constructed of 18-gauge steel with locking hinged door. Unless otherwise specified, all controllers, electric relays, switches and other equipment furnished as part of the control system which are not required to be mounted on mechanical equipment, shall be cabinet mounted. The temperature indicators and switches shall be flush mounted on the door tagged with plastic labels. All electrical devices shall be wired to a numbered terminal strip and all devices shall be completely adjusted and checked for proper operation prior to shipment to job site. All wiring shall be numbered according to the control diagram.

2.5 SEQUENCE OF OPERATION – Air Handling Unit Control with DX Cooling

A. The sequence that follows is typical for units AHU-1, AHU-2, and AHU-3. Each unit consists of a supply fan, DX cooling coil, filter section, and return inlet plenum. Interface each unit with its corresponding outdoor condensing unit ACC-1, ACC-2, and ACC-3 with controls that are factory furnished and installed on each unit.

B. Each air handling unit shall be controlled by an individual DDC Controller. The DDC Controller shall be wired to the existing zone control panel located in the IT Equipment Room. Provide a discharge air temperature sensor and return air temperature sensor for each unit.

C. Provide a wall mounted space temperature sensor and high limit temperature sensor as shown on the drawings. Interface these sensors with the existing zone control panel for staging, monitoring and alarm conditions of the system.

D. The zone control panel shall activate each air handling unit in sequence to maintain space temperature at 75 degrees F, adjustable. Two units shall operate as required with one unit on standby. Once activated, the supply fan shall run continuously. On a rise in space temperature above the programmed setpoint, the DX cooling coil and outdoor condensing unit shall be activated to provide cooling.

E. The system shall rotate the lead unit on a minimum weekly basis or as reset manually at the BAS.

F. If any air handling unit fails to start once activated after a twenty-second time delay, the system shall activate the standby unit and provide an alarm condition to the system. Temperature sensor in the room shall monitor space conditions and activate an alarm whenever the space temperature is at or above 80 degrees F, adjustable. Coordinate with the Owner's representative for required dial out capability to a remote site or pager upon unit failure or high limit alarm. Provide a current sensor on one leg of power to the fan motor in each unit to monitor fan status.

G. The BAS shall interface with a common "Global" fire alarm input from the fire alarm system. The fire alarm contact shall be provided at the fire alarm panel by the fire alarm system vendor. The status of the alarm contact shall be communicated throughout the BAS. When the fire alarm contact indicates an alarm condition, the BAS shall de-energize the supply fan.

H. Duct smoke detectors shall be provided in the area near the unit as part of the work of Division 26 - Electric. The detectors shall be wired to the existing fire alarm system. The Fire Alarm System shall activate an alarm to the BAS to de-energize the supply fan. Once the FAS is reset, the units shall resume operation based on last unit(s) running.

The following items shall be displayed through the existing system:

1. Space temperature.
2. Discharge air temperature.
3. Room high limit status/alarm.
4. Return air temperature.
5. Fire alarm system status/alarm.
6. Commanded status of fans.
7. Supply fan operational status/alarm via current sensor.
8. Diagram showing the layout of the equipment with major components and dynamic temperatures shown where temperature sensors exist in the system.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install system and materials in accordance with manufacturer's instructions and roughing-in drawings, and details and drawings. Install electrical work and use electrical products complying with requirements of these specifications. Mount controllers at convenient locations and heights.

B. All wiring shall be properly supported and run in a neat and workmanlike manner. All wiring exposed and in equipment rooms shall run parallel to or at right angles to the building structure. All wiring within enclosures shall be neatly bundled and anchored to prevent obstruction to devices and terminals. All wiring shall be in accordance with all local and national codes. All wiring for space temperature sensors, communication bus between terminal units, etc., shall be installed in EMT conduit. All electronic wiring shall be #18 AWG minimum THHN and shielded if required, except standard network (Ethernet, LonWorks, etc.) cabling shall be as tested and recommended in lieu of #18 gauge twisted, #22 or #24 gauge is acceptable if used as a part of an engineered structured cabling system. The control manufacturer must submit technical and application documentation demonstrating that this cabling system has been tested and approved for use by the manufacturer of both the control system and the engineered structured cabling system.

C. Provide all sensing, control, and interlock wiring for the following:

System inputs and outputs
System communications
System power
System interlocks
Unit controls

D. The Control Manufacturer shall enter all computer data into the Host computer including all graphics, control programs, initial approved parameters and settings, and English descriptors. The Control Manufacturer shall maintain diskette copies of all data file and application software for reload use in the event of a system crash or memory failure. One copy shall be delivered to the owner during training sessions, and one copy shall be archived in the Control Manufacturer's local software vault.

3.2 DATA CONTROL (D/C) AND GRAPHICS SUMMARY

A. All hardware, custom software, application software, graphics, etc., necessary to accomplish the control sequences and display the graphics specified shall be provided as part of this contract. Provide all controllers, inputs, outputs, valves, dampers, actuators and flow meters required to provide the control and graphic data described. Provide software setpoints required for display in logical groups and graphics.

B. Each digital output shall have a software-associated monitored input. Any time the monitored input does not track it's associated command output within a programmable time interval, a "command failed" alarm shall be reported.

C. Where calculated points (such as CFM) are shown, they shall appear in their respective logical groups.

D. Unless otherwise specified or approved prior to bidding, the primary analog input and the analog output of each DDC loop shall be resident in a single remote panel containing the DDC algorithm, and shall function independent of any primary or UC communication links. Secondary (reset type) analog inputs may be received from the primary network, but approved default values and/or procedures shall be substituted in the DDC algorithm for this secondary input if network communications fail or if the secondary input becomes erroneous or invalid.

3.3 ACCEPTANCE

A. The Control Manufacturer shall completely check out, calibrate and test all connected hardware and software to insure that the system performs in accordance with the approved specifications and sequences of operations approved.

B. Witnessed acceptance demonstration shall display and demonstrate each type of data entry to show site specific customizing capability; demonstrate parameter changes; execute digital and analog commands; and demonstrate DDC loop stability via trend of inputs and outputs.

3.4 MANUALS

A. The following manuals will be provided:

1. An Operators Manual shall be provided with graphic explanations of keyboard use for all operator functions specified under Operator Training.

B. Computerized printouts of all GPC data file including all point processing assignments, physical terminal relationships, scales and offsets, command and alarm limits, etc.

C. A manual shall be provided including revised as-built documents of all materials required under the paragraph "SUBMITTALS" on this specification.

D. Two Operators Manuals, and two As-Built Manuals shall be provided to the owner.

3.5 TRAINING

A. All training shall be by the BMCS contractor and shall utilize operators manuals and as-built documentation.

B. Operator training shall include one (1) four-hour session encompassing modifying text and graphics, sequence of operation review, selection of all displays and reports, use of all specified OWS functions, troubleshooting of sensors (determining bad sensors), and password assignment and modification. Training session shall be conducted at system completion.

3.6 SERVICE GUARANTEE

A. The control system herein specified shall be free from defects in workmanship and material under normal use and service. After completion of the installation, the control manufacturer shall regulate and adjust all thermostats, control valves, motors and other equipment provided under this contract. If within twelve (12) months from date of acceptance either for beneficial use of final acceptance, whichever is earlier, any of the equipment herein described is proven to be defective in workmanship or materials, it will be replaced or repaired free of charge. The control manufacturer shall, after acceptance, provide any service incidental to the proper performance of the control system under guarantee outlined above for the period of one year. Normal maintenance of the system or adjustments of components is not to be considered part of the guarantee. The control manufacturer will upon completion of the installation, during the warranty period, make available to the Owner, an annual service agreement covering all labor and material required to efficiently maintain the control system.

3.7 FINAL ADJUSTMENT

A. After completion of installation, adjust thermostats, control valves, motors and similar equipment provided as work of this section.

B. Final adjustment shall be performed by specially trained personnel in direct employ of installer of primary temperature control system.

END OF SECTION 230900

SECTION 230950

TESTING & BALANCING OF MECHANICAL SYSTEMS

PART 1 – GENERAL

1.1 JOB CONDITIONS

A. Systems shall be completely installed and in continuous operation as required to accomplish the tests.

B. Heating, ventilating and air conditioning equipment shall be completely installed and in continuous operation as required to accomplish the balance work specified.

C. Adjust and balance shall be performed when outside conditions approximate design conditions indicated for heating and cooling functions.

D. Make at least two inspections of the mechanical systems during construction to verify that balancing procedures may be accomplished. Report findings to the Architect/Engineer.

E. Balancing firm shall balance Mechanical System two (2) times. The first time shall be considered a rough balance. Any discrepancy in air flow shall be addressed to the Architect/Engineer. The final balancing will be accomplished after review of rough balance reports.

F. The final balancing reports shall be submitted and approved prior to project's being considered complete; i.e., commencement of warranties.

1.2 ENGINEER QUALIFICATIONS

A. The firm shall be an independent organization having no affiliation with construction contractors, equipment sales or design engineering.

B. The firm shall specialize in balancing heating, ventilating and air conditioning systems.

C. The firm shall show proof of having balanced and tested at least five projects of similar size and scope.

D. All field work shall be under the direct supervision of a registered Professional Engineer who is a full-time employee of the balancing firm.

E. The firm shall be certified by and a member of the AABC (Associated Air Balance Council), or NEBB (National Environmental Balancing Bureau).

1.3 REPORT

A. Data Sheets:

1. Submit data sheets on each item of testing equipment required.

2. Include name of device, manufacturer’s name, model number, latest date of calibration and correction factors.

B. Report Forms:

1. Submit specimen copies of report forms.

2. Forms shall be 8-1/2 x 11 inch paper for loose-leaf binding, with blanks for listing of the required test ratings and for certification of report.

3. Reports shall be on standard forms published by AABC or NEBB.

PART 2 – PRODUCTS

2.1 AIR BALANCE INSTRUMENTS

A. Alnor Velometer with probes and alnor pitot tube.

B. Rotating Vane Anemometer: 4 inch size.

C. ASHRAE Standard Pitot Tubes, stainless steel 5/16 inch outside diameter, lengths 18 inches and 36 inches.

D. Magnehelic Differential Air Pressure Gauges, 0 to 0.5 inches, 0 to 1.0 inch and 0 to 5.0 inches water pressure ranges, each arranged as a portable unit for use with a standard Pitot tube.

E. Combination Inclined-Vertical Portable Manometer, range 0 to 5.0 inches water.

2.2 SYSTEM PERFORMANCE MEASURING INSTRUMENTS

A. Insertion Thermometers, with graduation at 0.5 degrees F for air and 0.1 degrees F for water.

B. Sling Psychrometer.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. Arrange and pay for all tests.

B. Notify Architect/Engineer at least three working days in advance of test and conduct in presence of Architect/Engineer.

C. Tests to be performed prior to insulation, covering or concealment.

D. Provide signed report of completion of test with signature of witnesses. Report shall indicate:

1. System Tested

2. Date

3. Specified test requirements and actual testing results

E. The balancing firm shall report to and review the work required with the Architect/Engineer before

beginning field balance work. The balancing firm shall make at least two inspections of the air systems during construction and shall report his findings in writing to the Architect/Engineer.

F. The balancing firm shall cooperate with the Architect/Engineer and the Mechanical Contractor to effect smooth coordination of the balancing work with the job schedule.

G. The balancing firm shall be responsible for getting the various systems into proper operation. They shall enlist the aid of the equipment suppliers and Mechanical Contractor as may be required to effect proper operation consistent with the contract plans and specifications.

H. When the balancing firm cannot balance a belt-driven piece of equipment with the supplied belts and sheaves, inform the Mechanical Contractor that the Mechanical Contractor shall provide additional sheaves as spelled out in other Division 23 Sections.

3.2 BALANCING PROCEDURE

A. Air System Balance:

1. With the fan supply system set to handle supply air, the balancing firm shall perform the following tests and compile the following information:

<u>Air Handling Equipment</u>

a. Design Conditions:

(1) CFM Supply Air
(2) Static Pressure
(3) Fan RPM

b. Installed Equipment:

(1) Manufacturer
(2) Size/Model Number
(3) Motor HP, Voltage, Phase, Full Load Amperes

c. Field Test:

(1) Fan Speed
(2) No Load Operating Amperes
(3) Fan Motor Operating Amperes
(4) Calculated BHP

d. Test for Total Air:

(1) Size of discharge and return air ducts.
(2) Number and locations of Velocity Readings taken.
(3) Duct Average Velocity
(4) Total CFM
(5) Return Air CFM

e. Individual Outlets (Registers and/or Grilles):

(1) Identify each outlet or inlet as to location and area and fan system
(2) Outlet, manufacture and type
(3) Outlet size
(4) Outlet free area, core area, or neck area
(5) Required FPM and test velocity found for each outlet.
(6) Required CFM and test results for each outlet

2. Testing and adjusting of individual outlets shall be performed under procedures recommended by the manufacturers of the outlets. All outlets shall be set for air pattern required and all main supply air adjusted and set for design CFM indicated. Any required changes in air patterns, settings, etc., necessary for achieving correct air balance, shall be provided by this Contractor. Total CFM of outlet shall agree with the grand total air volume for the fan(s).

B. In addition to the above work, the Balancing Firm shall check the operation of all automatic temperature control equipment; verify all thermostat, aquastat, etc., set-points and operations; and enlist the aid of the Mechanical Contractor and the Control Subcontractor to make necessary adjustments where required.

END OF SECTION 230950

SECTION 260000

GENERAL PROVISIONS – ELECTRICAL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other conditions, if any) and Division 1 as appropriate, apply to the work of this Section.

B. The specification or drawing and the design features or resulting construction disclosed, are the property of Furlow Associates, Inc., and shall not be reproduced without written permission.

1.2 DESCRIPTION OF WORK (Add or Delete Systems)

A. Provide all materials, equipment, labor, services and all appurtenances required to completely install and satisfactorily operate the various systems. The items listed below are for general guidance only and do not necessarily include the entire requirements for the project.

1. Coordination with other trades
2. Electrical service
3. Interior feeders
4. Lighting and power panels
5. Lighting branch wiring
6. Power wiring
7. Lighting fixtures and lamps
8. Wiring devices
9. Related work as herein described or otherwise defined under the heading "Related Work".

B. Wherever the term "provide" is used, it shall be understood to mean both "furnish" and "install".

1.3 RELATED WORK

A. Equipment specified in sections of Divisions 1 thru 25 that require electric power supply.

B. Work related to this trade as defined on the following contract drawings:

Architectural/Structural
HVAC
Plumbing

1.4 SITE CONDITIONS

A. Attention of all bidders is called to the necessity for a careful inspection of the site, its present condition and encumbrances, the extent of the work, the protection to be afforded to adjacent properties or structure, availability of utilities, the extent and nature of the material required to be excavated and the amount of fill and removal. He shall also determine local or site limitations which will affect construction.

1.5 PERMITS, INSPECTIONS AND ORDINANCES

A. All work shall be executed and inspected in accordance with local and state ordinances, rules and regulations and the requirements of public utilities having jurisdiction. The contractor shall secure and pay for all permits, inspections and connections required.

B. The Electrical Contractor shall furnish a certificate of inspection to the Owner at the time of completion.

C. Requirements of the following organization shall be considered minimum:

1. National Electrical Code
2. National Electrical Safety Code
3. OSHA
4. Local City and County Codes

D. Reference to technical societies, trade organizations and governmental agencies are in accordance with the following:

1. ANSI - American National Standards Institute
2. ASTM - American Society for Testing Materials
3. IEEE - Institute of Electrical and Electronics Engineers, Inc.
4. NEC - National Electrical Code
5. NEMA - National Electrical Manufacturer's Association
6. NFPA - National Fire Protection Association
7. MSS - Manufacturer's Standardization Society
8. IES - Illuminating Engineers Society
9. ETL - Engineering Testing Laboratories
10. EIA - Electronic Industries Association
11. OSHA - Occupational Safety and Health Administration
12. Federal Specifications
13. UL - Underwriters Laboratories, Inc.

1.6 QUALITY ASSURANCE

A. Provide adequate supervision of labor force to assure that all aspects of the contract documents are fulfilled.

B. Testing:

1. After completion of the work, the entire wiring system shall test entirely free from grounds, short circuits, opens, overloads and improper voltage.

2. The grounding system shall be tested for a resistance of 25 ohms or less.

3. Perform testing as follows: Arrange and pay for all tests, provide all equipment, materials and labor to perform test. Notify Engineer and Owner three (3) working days before tests are to be made. Conduct tests in the presence of the Engineer or authorized representative. Repeat tests after defects are corrected.

C. Special Engineering Services: In the instance of complex specialized electrical power and signaling systems, and other similar systems, the installation and final connections of these systems shall be

made by and/or under the supervision of a competent installation and service engineer who shall be a representative of the respective equipment manufacturer. Any and all expenses of these installation and service engineers shall be borne by this Contractor.

1.7 COORDINATION

A. As a requirement of this project, the Electrical Contractor shall furnish coordination for his equipment and layouts with other subcontractors furnishing equipment and services for Divisions 1 thru 25. Any and all contractors who install their equipment or furnish services prior to coordination, any contractor who changes their equipment or services after coordination has occurred, without notifying associated subcontractors, shall be held responsible for making all required changes with no additional cost to the Owner. Or delay in construction time. This coordination will include conduit layout to allow access to equipment for maintenance.

B. The Mechanical, Plumbing and Electrical Contractors are responsible to coordinate all manufacturer's recommended circuit breakers, starters, disconnects and fuse sizes for all equipment. Submission of a shop drawing will certify that this has been completed.

C. The drawings and specifications reflect the type, number and size of services required for the equipment the design is based upon. Should the supplying subcontractor elect to furnish an alternate piece of equipment requiring difference services and/or space conditions, he shall inform the subcontractor furnishing those services and be held responsible to pay for all required changes as part of this contract.

1.8 SUBMITTALS

A. Shop Drawings:

1. Shop drawings shall be submitted in accordance with Division 1 of these specifications except where herein modified.

NOTE: Submittals will only be reviewed once and resubmittals will be reviewed once. Any other submittals will be billed to the Contractor at the Engineer's standard rates.

2. Shop drawings comprising complete catalog cuts, performance test data for electrical equipment as required by other sections of Division 26 shall be submitted for review checking. The Contractor shall review these shop drawings for conformance to contract documents prior to submission and affix contractor's signature to each submittal certifying that this review has been done. By approving and submitting shop drawings, product data, wiring diagrams and similar materials, the Electrical Contractor represents that he and/or his subcontractor has determined and verified materials, field measurements and field construction data that relates to the work, and has checked and coordinated this information with all of the Divisions 1 thru 25 subcontractors.

3. All shop drawing submittals shall have the following identification data, as applicable, contained therein or permanently adhered thereto:

   a. Project name

   b. Project number

c. Sub-Contractor's, Vendor's and/or manufacturer's name and address.

d. Product identification.

e. Identification of deviation from the contract documents.

f. Applicable contract drawings and specification section number.

g. Shop drawing title, drawing number, revision number, and date of drawing and revision.

h. Resubmit revised or additional shop drawings as requested.

i. Wherever shop drawings or vendor's standard data sheets indicate work to be done "by others", it shall be the responsibility of the Contractor making the submission to identify by name, the Contractor who is to do this work. If the Contractor named is other than the Contractor making the submission, the shop drawing submission must be reviewed by the named Contractor and bear his mark of approval, prior to submission to the Engineer.

j. Where equipment proposed differs from that shown on the drawings or specified, he shall submit for approval drawings showing the manner in which the layout is affected by the substitution.

k. The Contractor shall keep one copy of approved shop drawings at the job site, filed in a suitable metal container. The shop drawings shall be cataloged and kept in good repair, and shall be available for use by the Owner and Engineer.

l. No equipment shall be ordered, fabricated, etc., before approval of shop drawings.

1.9 SUBSTITUTIONS

A. Whenever a material, article, piece of equipment or system is identified in the following specification or indicated on the drawings by reference to manufacturers' or vendors' names, trade names, catalog numbers or the like, it is so identified for the purpose of establishing the basis of the Bid.

B. Substitution approval must be obtained and included as an addendum item prior to the submission of the bid. An approved substitution shall not be considered as an approval for the contractor or an equipment vendor to deviate from the written portion of the specifications unless so stated in the addendum.

C. The drawings illustrate the space allocated for equipment and the Contractor shall install the equipment accordingly. If changes are required in the building or arrangement due to substitution of equipment, the Contractor making the substitution must pay for the necessary modifications.

D. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but shall not be limited to space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, then they shall be responsible for any and all additional costs associated with the changes required by other trades.

1.10 LUBRICATION

A. Furnish, install and maintain all required lubrication of any equipment operated prior to acceptance by the Owner. Lubrication shall be as recommended by the equipment manufacturer.

B. Provide one year's supply of lubricants to Owner at date of acceptance.

C. Verify that required lubrication has taken place prior to any equipment start-up.

1.11 ADJUSTMENT & CLEANING

A. Adjust and clean equipment to be placed in proper operation condition.

1.12 EQUIPMENT START-UP

A. Verify proper installation by manufacturer or his representative.

B. Advise General Contractor 2 days prior to actual start-up.

C. Verify proper operation. Obtain signed statement by manufacturer or his representative that equipment is operating within warranty requirements. Submit statement to General Contractor.

1.13 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Properly and fully instruct Owner's personnel in the operation and maintenance of all systems and equipment.

B. Insure that the Owner's personnel are familiar with all operations to carry on required activities.

C. Such instruction shall be for each item of equipment and each system as a whole.

D. Provide report that instruction has taken place. Include in the report the equipment and/or systems instructed, date, contractor, Owner's personnel, vendor, and that a complete operating and maintenance manual has been reviewed.

E. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalogue cuts, wiring diagrams, piping diagrams, control sequences, service requirements, names and addresses of vendors, suppliers and emergency contacts. Three manuals shall be provided.

F. Submit manuals for review prior to operating instruction period. Manuals shall be 8-1/2 x 11" with hard cover, suitably bound.

1.14 TOOLS

A. All equipment furnished by the Contractor which requires special tools or devices other than those normally available to the maintenance or operating staff shall be furnished in duplicate to the Owner, sufficiently marked, packed or boxed for staff usage. The tools provided shall be listed by the Contractor identified as to their use or the equipment applicable in a written transmittal to the Owner.

1.15 CLEANING AND FINISHING

A. After equipment start-up and all operating tests have been made and the system pronounced satisfactory, each respective Contractor shall go over the entire project, clean all equipment, etc., installed by him and leave in a clean and working condition. Any surfaces found marred after this final cleaning shall be refinished or replaced by each Contractor at no cost to the Owner.

1.16 OPERATING AND MAINTENANCE MANUALS

A. Three complete sets of instructions containing the manufacturer's operating and maintenance instructions for each piece of equipment shall be furnished to the Engineer. Each set shall be furnished before the contract is completed. The following identification shall be inscribed on the covers: the words "OPERATING AND MAINTENANCE INSTRUCTIONS", the name and location of the building, the name of the Contractor and the name of the Engineer. Flysheet shall be placed before instructions covering each subject. The instruction sheets shall be approximately 8-1/2 by 11 inches, with large sheets of drawings folded in. The instructions shall include, but shall not be limited to, the following:

Approved wiring and control diagrams, with data to explain the detailed operation and control of each component.

A control sequence describing start-up, operation and shutdown.

Operating and maintenance instructions for each piece of equipment, including lubrication instructions.

Manufacturer's bulletins, cuts and descriptive data.

Parts lists and recommended spare parts.

1.17 SERVICE INTERRUPTION

A. All service interruptions to the electric or related systems, whether during regular working hours or at any other time, must be coordinated with the Owner. All such interruptions shall be so scheduled and planned as to require a minimum of time and shall occur only during a mutually satisfactory period.

1.18 INTERPRETATION OF SYSTEMS

A. The interpretation of the Engineer will be final in the event there is a lack of understanding of the full scope or requirements of the systems under this contract.

1.19 LAYOUTS

A. On small scale drawings, i.e., 1/8" - 1'-0", the approximate location of the electrical branch circuit items such as receptacle, grounding, and equipment outlets are shown to indicate their existence. The exact location of these items and their related raceways are governed by structural conditions, coordination with the work of other trades and the Engineer's final decision. By accepting a contract, the Contractor agrees to install the work in accordance with the above statement and within the contract price.

PART 2 – PRODUCTS

2.1 MATERIAL

A. All material shall be new and of good quality. Material shall conform to all accepted trade standards, codes, ordinances, regulations, or requirements governing same, and shall be approved before being installed.

B. The Engineer reserves the right to require the Contractors to submit samples of any or all articles or materials to be used on the project.

C. Where any device or equipment is herein referred to in the singular number, such as "the panel", this reference shall be deemed to apply to as many such devices or equipment as are required to complete the installation as shown on the drawings or specified.

D. All materials and equipment used in the work shall comply with the standards of recognized authorities such as UL, NEMA, IEEE, ETL, IES and EIA in every instance where such standards have been established for the particular type of materials to be installed.

E. All similar pieces of equipment or materials of the same type or classification used for the same purpose shall be of the same manufacturer.

F. All manufactured equipment shall have factory applied finishes.

2.2 CONCRETE

A. Concrete shall be in accordance with Section 03300, or ACI-613. Designer choice if 03300 is not used.

B. The 28-day minimum compressive strength shall be 3000 psi.

2.3 WARRANTY

A. Wherever in the specification sections of this division, reference is made to a specific warranty period, this warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the contract documents.

PART 3 – EXECUTION

3.1 INSPECTION

A. Prior to performing the work, examine areas and conditions; check and verify all dimensions, under which the work is to be installed and notify the Engineer in writing of conditions and dimensions detrimental to the proper and timely completion of the work. Do not proceed until authorization is given by the Engineer.

3.2 LAYING OUT WORK

A. The Contractor is responsible for the accuracy of all lines, elevations, and measurements, grading and utilities and must exercise proper precaution to verify figures shown on drawings before laying out work and will be held responsible for any error resulting from his failure to exercise such precaution.

3.3 WORKMANSHIP

A. Install all work neat, trim, parallel and plumb with building lines in accordance with standard trade practice acceptable to the Engineer.

3.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect all equipment and materials from damage during transportation, storage and installation.

3.5 PROTECTION

A. Protect all work, equipment and materials during construction up to the time of acceptance by the Owner.

Arrange and design the protection to prevent damage from infiltration or dust, debris, moisture, chemicals and water. Cap or plug electrical raceways.

B. Protect all surfaces against damage from welding, cutting, burning, or similar construction functions. This protection shall be accomplished by care in operations, covering and shielding. Special care is directed to exposed finished masonry, metal or wood surfaces and painted surfaces. Corrective measures required shall be accomplished by the trade which made the original installation when and as directed by the Engineer at the expense of the Contractor.

C. Cover and protect all lighting fixtures as may be necessary until completion of the work. Replace damaged fixtures or damaged fixture parts as directed by the Engineer at no cost to the Owner.

D. Do not install devices, polished metal fittings or parts until adjoining tile or masonry work is completed.

E. Maintain and replace protective covering when so directed by the Engineer until the work is ready for acceptance.

3.6 CUTTING & PATCHING

A. Furnish information to the General Contractor as to sizes and locations of recesses required to install panel boxes and other equipment or devices. If the information is late or incorrect, this Contractor shall, at his own expense, have the trade which originally installed the work do the required cutting and patching.

B. Perform all cutting of concrete or other material for passage of raceways as required to install the work.

C. Close all such openings around raceways with material as specified under the heading "SEALING".

D. Install concealed work in place for the mason to wall-in as he carries up the walls; otherwise, this Contractor will be responsible as stated in the first paragraph.

3.7 SEALING

A. Where raceways pass through fire-rated walls and floors, seal opening with RTV foam.

B. Seal raceways entering the building to conform to the requirements of the NEC.

3.8 OFFSETS AND MODIFICATIONS

A. Furnish and install all offsets necessary to install the work and to provide clearance for the work of other trades.

B. Maintain adequate clearance as directed by the Engineer.

C. Incidental modifications necessary to the installation shall be made as necessary and at the direction and/or approval of the Engineer.

3.9 SLEEVES

A. Furnish and install sleeves for all raceways passing through floors and walls. Sleeves shall be Schedule 40 galvanized steel pipe and shall extend 1" above finished floor surface. Where sleeves are set in interior walls, they shall finish flush with the wall.

B. Furnish and install watertight sleeves for all raceways extending through foundation walls into crawl spaces, mechanical rooms or basement areas from building exterior or from unexcavated areas to building interior. Sleeve shall consist of extra heavy pipe sleeve with anchor flange. Space between raceway and the sleeve shall be sealed with modular wall and casing seal similar to Thunderline Corporation "Link-Seal",, Metraseal or approved substitute. Install seal in strict accordance with the manufacturer's recommendations.

3.10 EXCAVATION

A. The excavation shall be of the open-trench method and to the depths and widths as may be necessary. The Contractor shall do all excavation required in connection with his work. Bottoms of trenches shall be excavated to a uniform grade. All materials excavated shall be deposited on the side of the trenches and beyond the reach of slides. Excavated material shall not be piled where it will interfere with traffic.

B. No conduits shall be bedded directly on rock. They shall be cushioned by a 6-inch layer of crushed stone or gravel of selected grade, of size to pass through a 3/4" mesh sieve. Not less than 30% shall be fine which will pass through a 3/8" mesh sieve.

C. Where excavation is required through tree root areas, roots shall be saw cut, treated with pruning paint and covered with burlap. Burlap shall be wet and shall be protected and maintained in a moist condition during entire period of exposure. Backfill shall be carefully placed and hand-tamped to a minimum of 6" above roots.

D. Bidder shall base his estimate upon the presumption that all excavation required in the performance of this Contract will be earth. If rock is encountered, Contractor will be reimbursed for the additional work required to remove same based upon the unit cost established in the proposal.

E. All detached boulders or loose stone not exceeding 1 cubic yard, all topsoil, sand, gravel, clay, rubbish, walls or other subgrade construction, and all other materials of every name and nature which can be removed without breaking up with pneumatic breakers or explosives shall be considered earth

excavation.

F. All rocks, attached boulders, boulders exceeding 1 cubic yard, walls or other subgrade construction and materials which cannot be removed without breaking up with pneumatic equipment or explosives shall be considered rock excavation.

G. Before commencing any rock excavation for which extra compensation is to be paid, a rock contour drawing shall be prepared by the Contractor and checked by the Engineer. The width shall be based on 2'-0". This rock contour drawing and width allowance will be used to compute the quantity of rock for which the Contractor will be reimbursed at the unit price established.

3.11 SHORING AND PUMPING

A. The Contractor shall provide all shoring, bracing or sheet piling necessary to maintain the banks of his excavation and shall take out same as the work progresses and filling in has been accomplished. Shoring shall be in accordance with OSHA Standards.

B. The arrangement of shoring must be such as to prevent any movement of the trench banks and consequent strains on the conduits. Shoring shall be provided to prevent damage to work installed by other trades.

C. The Contractor shall do all pumping required to keep his excavations free of water. The water shall be conveyed in piping or watertight troughs a sufficient distance that it will flow from the site and not affect other work being performed.

3.12 BACKFILLING

A. After work in trenches has been completed, they shall be filled with good, clean, fine earth in 8" layers and shall be pneumatically tamped before the next layer of material has been filled in. The backfill shall be free of excavated rock, cinders, stones, brickbats or other debris.

B. Wherever rock is removed, the Contractor shall secure and fill select clean earth to a minimum depth of 3'-0" above the top of the conduit. Unless otherwise indicated, no rock shall be deposited in the trench fill. This clean earth fill shall be procured other than from the site unless permission for earth borrow from the site is granted by the Engineer. If site borrow is permitted, the topsoil removal, relocation and finished grading will be accomplished as directed by the Engineer.

C. Under no circumstances shall excavated material be left where it will interfere with the Owner's or other Contractor's operations.

D. All earth and other materials taken from the trenches and not required for backfilling shall be deposited where directed, or removed from the premises as directed by the Engineer.

E. Any rock removed from the excavation shall be removed from the project site by the Contractor.

F. Trenches which pass under wall footings or within 18" of column footings shall be backfilled with clean concrete. To secure adequate foundation support, the method and depositing of the concrete fill shall be as directed by the Engineer. To prevent the concrete from adhering to the conduits, necessary conduit protection shall be applied.

3.13 FOUNDATIONS FOR EQUIPMENT/HOUSEKEEPING PADS

A. Provide all foundations for equipment installed under this specification Division and/or as indicated on plans.

B. Construct concrete foundations on structural floor slabs or on grade in the manner or as required by the approved shop drawing details of the manufacturer or the utility company.

C. Provide and install concrete.

D. Metal reinforcement shall be deformed steel bars or cold drawn steel wire, or fabricated forms of these materials as required.

E. Furnish anchors of size and number noted, with bottom plates and sleeves.

F. Forms shall conform to the shape, lines, grades, and dimensions of the concrete, required by the approved shop drawing details of the equipment manufacturers, or approved on the Contractor's Equipment room layouts. They shall be sufficiently tight to prevent leakage of mortar and shall be braced or tied together to maintain position and shape. Forms shall be moved in such manner as to insure the complete safety of the structure.

G. All exposed corners or edges shall be chamfered. All burrs, fins, irregularities of forming or spillage shall be removed and the surface float or trowel finished to a smooth, straight surface.

H. Housekeeping Pads: Provide 4" thick, and size as required by approved shop drawings, concrete pad for all equipment installed on floor. Pad shall be steel reinforced with all edges and surfaces finished as described above. When installing over existing concrete, surface of existing pad shall be prepped using a bushing tool to rough in entire surface. Whether pouring over new or existing concrete, provide U-shaped rebar anchors set in epoxy to secure pad to pad.

3.14 ITEMS RECESSED IN MASONRY CONSTRUCTION

A. Wherever boxes, electric panels, equipment, devices, access panels, and similar items of electrical construction are installed in exposed masonry construction, the Contractor shall utilize and submit for approval items of such size, height, and arrangement to conform to the corresponding masonry unit. The Contractor shall include as part of this contract, the necessary offsets, adjustments and relocations necessary to conform with the instructions of the Engineer as to the final location of the equipment item in the exposed masonry.

B. As part of his contract and before the purchase of the items hereinbefore mentioned, the Contractor shall notify the Engineer of such modifications in the building arrangement that will be necessary to accommodate the proposed equipment.

3.15 PAINTING

A. Refinish all factory applied finishes that have been damaged to match the original finish as directed by the Engineer.

B. Prime coat all steel furnished under this Division with material and methods as described in another Section under the heading "PAINTING".

3.16 EQUIPMENT CONNECTIONS

A. Provide required wiring, raceways and final connections for all equipment provided by this Division and Divisions 1 thru 25.

B. Make final connections in accordance with wiring diagrams obtained from equipment manufacturer.

C. Rough-in in accordance with approved shop drawings from the manufacturer or supplier of the equipment. Rough-in prior to shop drawing approval will be subject to change without adjustment to contract cost.

3.17 BALANCING

A. The system of feeder and branch circuits for power and lighting shall be connected to panel busses in such a manner as to electrically balance the connected load as close as is practicable. Should the Owner disclose any unfavorable conditions reacting on the service, this Contractor shall make such changes as may be suggested to balance the load.

3.18 GUARANTEE

A. All work shall be guaranteed to be free from defects for a period of one year of operation from date of acceptance by the Owner unless otherwise specified in Division 1.

B. Guarantee shall be extended on an equal time basis for all non- operational periods due to failure within the guarantee period.

END OF SECTION 260000

SECTION 260005

SCOPE OF WORK - ELECTRICAL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including the conditions of the Contract (General, Supplementary and other conditions, if any) and Division 1 as appropriate, apply to the work of this section.

PART 2 – DESCRIPTION

2.1 GENERAL

A. Provide labor, material, equipment and supervision to install complete and operating systems as specified herein and as shown on the drawings. The items listed below are for general guidelines only and do not necessarily include the entire requirements for the project:

1. Furnish all required labor, drawings and sketches needed to coordinate the selected equipment and services with associated subcontractors furnishing equipment and services for Divisions 1 thru 15. No equipment shall be installed or services furnished until all coordination is complete and agreed to by all contractors involved, should a contractor change his selection or require difference services after coordination is complete, then that contractor shall pay all required costs in resolving the conflict. This coordination will include conduit layout to allow access to equipment for maintenance.

2. The electrical branch and feeder circuit sizes feeding Divisions 1 thru 25 equipment are based upon a predetermined base equipment design with a number of alternate manufacturers given. Should the Divisions 1 thru 25 contractors select a listed alternate manufacturer, he shall inform the Electrical Contractor of the change. The Electrical Contractor shall calculate the cost of the changes if any. These costs shall be passed on to the Division Subcontractor making the change at no additional cost to the project.

3. The electrical design and equipment layouts indicated on the drawings and stated herein are based on predetermined equipment selections and every effort has been made to meet the requirements of the National Electrical Code (NEC), National Fire Protection Association (NFPA), state and local codes and regulations for clearances and access. The codes and regulations for this project are binding on both the design level and the installation level. It shall be the responsibility of the Electrical Contractor or his inspection agency to review the installation process of the design prior to actual installation. Should a conflict develop between the subcontractor and another division subcontractor's work, it shall be brought to the attention of the Engineer. Overlooking or dismissing a conflict shall not relieve the subcontractor of his responsibility for the cost of the change order to remove and reinstall the equipment to clear up a conflict.

4. Furnish all required labor, supervision and coordination needed to disconnect power and make safe all existing electrical circuits in the building in preparation for general demolition. It shall be the responsibility of the Electrical Contractor to coordinate the removal of all disconnects, junction boxes, panelboards, switchboards, conduit and wire indicated on the Contract

Documents. All associated surface mounted electrical equipment, including raceways shall be removed, all conduit installed in walls shall be cut free and removed with general demolition.

5. Furnish all required labor, materials, supervision and coordination needed to install new primary and secondary services into the building as indicated in contract documents. The Electrical Contractor shall be responsible for furnishing and installing a complete distribution system as indicated on the single line diagram, shown on the floor plans and specified in the project specifications.

END OF SECTION 260005

SECTION 260055

ELECTRICAL IDENTIFICATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. This section is a Division 26 Basic Materials and Methods Section, and is part of each Division 26 Section making reference to electrical identification specified herein.

1.2 DESCRIPTION OF WORK

A. Types of electrical identification specified in this section include the following:

Cable conductor identification.
Operational instructions and warnings.
Danger signs.
Equipment/system identification signs.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products of one of the following (for each type of marker):

W. H. Brady Co.
Ideal Industries, Inc.
Seton Name Plate Co.
3M Electrical Products

2.2 ELECTRICAL IDENTIFICATION MATERIALS

A. Provide manufacturer's standard products of categories and types required for each application. Where more than a single type is specified for an application, selection is Installer's option, but provide single selection for each application.

2.3 COLOR-CODED PLASTIC TAPE

A. Provide manufacturer's standard vinyl tape not less than 7 mils thick by 3/4" wide.

B. Colors: Unless otherwise indicated or required by governing regulations, provide tape color as indicated in Paragraph 3.2.B.

C. Tape shall be of Type 3M Scotch 35 for color coding, Scotch Super 33+ for splices and Tem Flex 1700 for general use.

2.4 CABLE/CONDUCTOR IDENTIFICATION BANDS

A. Provide manufacturer's standard vinyl cloth, self-adhesive cable/conductor markers of wrap-around type; either pre-numbered, plastic-coated type, or write-on type with clear plastic, self-adhesive cover flap; numbered to show circuit identification.

2.5 BAKED ENAMEL DANGER SIGNS

A. Provide manufacturer's standard "DANGER" signs of baked enamel finish on 20-gage steel; of standard red, black and white graphics; 14" x 10" size except where 10"x 7"is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording (as examples: HIGH VOLTAGE, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH).

2.6 ENGRAVED PLASTIC-LAMINATE SIGNS

A. Provide engraved stock melamine plastic laminate, in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.

C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

2.7 LETTERING AND GRAPHICS

A. Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of electrical systems and equipment.

PART 3 – EXECUTION

3.1 APPLICATION AND INSTALLATION

A. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.

B. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

3.2 CABLE/CONDUCTOR IDENTIFICATION

A. Apply cable/conductor identification on each cable and conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project electrical work.

B. Conductor Color Coding:

1. All conductors used in all systems shall have insulation that is inherently colored. All conductors of a system performing the same function shall be colored alike throughout the project.

2. Equipment Grounding Conductors:

   a. Standard and/or general feeders or circuits shall be green.
   b. Isolated feeders or circuits shall be green with yellow stripe.

3. On larger conductors, where colored insulation is not available, colored tape adhesive vinyl bands 3/4" width may be installed 6" maximum from the end of the conductors. Where passing through pull boxes without splice, each conductor shall be banded.

4. Power system conductor colors shall be as follows:

   a. 120/208 Volt System

      Phase A - Black
      Phase B - Red
      Phase C - Blue
      Neutral - White or Gray

3.3 DANGER SIGNS

A. In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations indicated and at locations subsequently identified by Installer of electrical work as constituting similar dangers for persons in or about project.

B. High Voltage: Install danger signs wherever it is possible, under any circumstances, for persons to come into contact with electrical power voltages higher than 110-120 volts.

3.4 EQUIPMENT/SYSTEM IDENTIFICATION

A. Install engraved, plastic laminate sign on each major unit of electrical equipment in building, including central or master unit of each electrical system including communication/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/2" high lettering on 1-1/2" high sign (2" high where 2 lines are required), white lettering in black field. Provide text matching terminology and numbering of the contract documents and shop drawing. Provide signs for each unit of the following categories of electrical work:

   1. Panelboards, electrical cabinets and enclosures.
   2. Access panel/doors to electrical facilities.
   3. Major electrical switchgear, main and feeder circuit breakers and/or disconnects.

B. Install signs at locations for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate the substrate.

3.5 JUNCTION AND PULL BOX IDENTIFICATION

A. Feeders Shown on Single Line Diagram: Each junction and pull box shall be marked with black

indelible liquid marker with the assigned feeder number "FDR #38" in 3/8" letters minimum.

END OF SECTION 260055

SECTION 260110

RACEWAYS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other conditions, if any) and Division 1 as appropriate, apply to the Work specified in this Section.

B. Refer to Section 260000 for General Provisions - Electrical.

1.2 DESCRIPTION OF WORK

A. Types of raceways in this section include the following:

Rigid metal conduit
Intermediate metal conduit
Electrical metallic tubing.
Polyvinyl chloride conduit (Exterior Underground Only)
Flexible metal conduit.
Liquid-tight flexible metal conduit.
Wireways.

1.3 REFERENCE STANDARDS

A. Refer to Section 260000 for a general description of requirements applying to this Section.

1.4 QUALITY ASSURANCE

A. Refer to Section 260000 for a general description of requirements applying to this Section.

1.5 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

1.6 COORDINATION

A. The drawings and details there upon are scheme and/or diagrammatic in nature, and indicate the need and intent of the design. These are to be used for general guidance only. It shall be the responsibility of the Electrical Contractor to coordinate, with other Division Subcontractors, the installation of all raceways, raceway supports, junction boxes and required fittings. This coordination will include conduit layout to allow access to equipment for maintenance.

B. This coordination shall be carried out prior to actual installation; this shall be done to eliminate the possibility of conflicts between trades on items such as access, clearances and maintenance issues that may arise after completion of construction.

C. Should the coordination not be carried out prior to installation, and a conflict exists, the installing contractor shall remove and reinstall the equipment as required to clear the conflict at no additional cost to the Owner and no delay in project completion.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Rigid Metal Conduit:

1. Raceway: Full weight, heavy wall rigid steel with zinc coating conforming to ANSI-C80.1.

2. Fittings: Cast malleable iron fittings with threaded hubs, insulated throat and zinc protective coating.

3. Subject to compliance with requirements, provide products of one of the following:

   Allied Tube and Conduit Corporation
   LTV Steel Tubular Products Co.
   Wheatland Tube

B. Intermediate Metal Conduit:

1. Raceway: Light weight, rigid steel, hot dipped galvanized manufactured in accordance with UL1242.

2. Fittings: Cast malleable iron fittings with threaded hubs, insulated throat and zinc protective coating.

3. Subject to compliance with requirements, provide products of one of the following:

   Allied Tube and Conduit Corporation
   LTV Steel Tubular Products Co.
   Wheatland Tube

C. Electrical Metallic Tubing:

1. Raceway: Light weight, thin wall, rigid steel, hot dipped galvanized manufactured in accordance with ANSI C80.3.

2. Fittings: Raintight, insulated throat, compression type with zinc protective coating.

3. Subject to compliance with requirements, provide products of one of the following:

   Allied Tube and Conduit Corp.
   LTV Steel Tubular Products Co.
   Wheatland Tube Co.

D. Polyvinyl Chloride Conduit:

1. Raceway: Heavy wall, rigid non-metallic, schedule 40 with bell type end, designed for above ground exposed applications, direct earth burial, and concrete encasement.

2. Fittings: Polyvinyl chloride, heavy duty, glue type, designed for Schedule 40 application.

3. Subject to compliance with requirements, provide products of one of the following:

   Allied Tube & Conduit
   Carlon
   Queen City Plastics, Inc.
   Scepter Electric Systems

E. Flexible Metal Conduit:

1. Raceway: Construct of single strip, flexible, continuous, interlocked, and double-wrapped steel, galvanized inside and outside.

2. Fittings: Steel, insulated throat, with zinc protective coating.

3. Subject to compliance with requirements, provide products of one of the following:

   AFC
   Alflex Corp.
   Electri-Flex Company

F. Liquid-Tight Flexible Metal Conduit:

1. Raceway: Construct of single strip, flexible, continuous, interlocked, and double-wrapped, galvanized inside and outside, coat with liquid-tight jacket of flexible polyvinyl chloride.

2. Fittings: Steel, water and oiltight, insulated throat, with zinc protective coating.

3. Subject to compliance with requirements, provide products of one of the following:

   AFC
   Alflex Corp.
   Electri-Flex Company

G. Wireways:

1. Furnish electrical wireways of the type, size, and style for each service indicated. Wireway shall be a complete assembly including but not necessarily limited to, couplings, offsets, elbows, adapters, hold-down clips, end-caps and other components and accessories as needed for a complete system.

2. System shall fulfill wiring requirements as indicated in contract documents, and shall comply with applicable portions of Article 362 of the National Electrical Code.

3. Subject to compliance with requirements, provide products of one of the following:

Circle AW Products Co.
The EMF Company, Inc.
Hoffman Engineering Company
Square "D" Company

H. The above items shall include the statement "Approved Equal" and/or "Approved Substitute". This statement requires that the product or item be in compliance with the written intent of this specification and the submission meets the requirements of Section 260000.

PART 3 – EXECUTION

3.1 INSTALLATION OF ELECTRICAL RACEWAYS

A. Install electrical raceways in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA "Standard of Installation", and complying with recognized industry practices.

B. Coordinate with other work as necessary to interface installation of electrical raceways, wireways and required components.

C. Raceways used for distribution, feeders, or branch circuits shall be a minimum size of 3/4" or equal equivalent cross-sectional area. Raceways used for control and signal shall be a minimum size of 1/2" or equal equivalent cross-sectional area.

D. All raceways installed in ceiling cavities and exposed within mechanical spaces shall be run parallel with building lines and installed level and square at the proper elevation/height.

E. Complete the installation of electrical raceways before starting the installation of cables/wires within the raceway.

F. Furnish and install one (1) nylon or fiberglass pull cord in each empty raceway. Each empty raceway shall be cleaned, capped, and tagged as to its termination location.

G. Install liquid-tight flexible metal conduit for connections to motors and for other electrical equipment when subject to movement and vibration, and also where subjected to one or more of the following conditions:

1. Exterior locations.
2. Moist or humid atmosphere when condensation can be expected to accumulate.
3. Corrosive atmosphere.
4. Subjected to water spray.
5. Subjected to dripping oil, grease or water.

H. Install Electrical Metallic Tubing for building interior electrical work except:

1. Underground
2. In gravel, cinder, concrete or other sub-base floor construction.
3. Horizontal runs in concrete floor slabs.
4. Where exposed to the elements.
5. In masonry construction below finished grade.
6. Vertically in poured concrete walls.

I. Refer to Section 260000 for excavation, shoring and pumping, concrete and backfilling requirements.

J. Where and whenever possible, install horizontal electrical raceways as tight to building construction as possible and above water, drain and steam piping. A separation of at least six (6) inches shall be maintained between electrical conduits and hot water and steam piping.

K. In accordance with NEC requirements, install Rigid or Intermediate Metal Conduit where Electrical Metallic Tubing is not permitted.

L. In all instances where recessed type panelboards are installed, furnish and install one (1) one inch raceway for each two (2) future circuits for which "space" or "spare" provisions have been made in the panelboard. These raceways shall extend between the panelboard cabinet and a convenient location above an access panel or a removable tile ceiling construction and capped.

3.2 CLEANING

A. Upon completion of installation of raceways, inspect interiors of raceways; remove burrs, dirt and construction debris.

END OF SECTION 260110

SECTION 260120

WIRES AND CABLES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. This section is a Division 26 Basic Materials and Methods section and is part of each Division 26 Section making reference to wires and cables specified herein.

1.2 DESCRIPTION OF WORK

A. Electrical wire and electrical cable work is indicated by drawings and specifications.

B. Arrange for and coordinate with the Utility Company and pay any and all costs in conjunction with the 25KV primary service from the point of connection to 25KV pad-mounted transformer.

C. Types of wire, cable and connectors in this section include, but not limited to the following:

Copper conductors.
Tap type connectors.
Split-bolt connectors.

D. Refer to other sections of Division 26 for, but not limited to, raceways, connections used in conjunction with wire and cable work.

E. Applications for wire, cable and connectors required for project are as follows unless otherwise indicated:

1. Primary Service Circuitry.
2. Power Distribution Circuitry.
3. Appliance and Equipment Circuitry.
4. Motor Branch Circuitry.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. <u>Wire and Cable</u>
Anaconda Wire and Cable Co.
Advance Wire and Cable, Inc.
American
Cerro Wire and Cable Co.
Electrical Conductors, Inc.
General Cable Corp.
Hitemp Wires, Inc.
Rome Cable Corp.
Southwire Company
Triangle PWC,, Inc.
The Okonite Co.

General Electric Co.

Connectors
Burndy Corp.
Eagle Electric Mfg. Co., Inc.
Gould, Inc.
Ideal Industries, Inc
Joslyn Mfg. and Supply Co.
O-Z/Gedney Co.
Pyle National Co.
Thomas and Betts Co.

2.2 WIRE, CABLE AND CONNECTIONS

A. Except as otherwise indicated, provide wire, cable and connectors of manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer, and as required for the installation. Minimum wire and cable size is #12 AWG for power and branch circuits and #14 AWG for control and signal/communication circuits unless otherwise indicated.

B. Wire: Provide factory fabricated wire of sizes, ratings, materials and types indicated for each service. Where not indicated, provide proper selection as determined by Installer to comply with project's installation requirements and NEC standards. Select from the following types, materials, conductor configurations, insulation and coverings:

UL Type: THHN
UL Type: TW
UL Type: THW
UL Type: THWN
UL Type: TF
UL Type: XHHW

Material: Aluminum (Service Entrance Only)
Copper

Conductors: Solid (AWG 14 to AWG 10 only).
Conductors: Concentric-lay-stranded (standard flexibility)

Outer Covering: Nylon
Outer Covering: Thermoplastic

C. Connectors: Provide factory fabricated metal connectors of sizes, ratings, materials, types and classes as required for each service. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements and NEC standards. Select from the following types, classes, kinds and styles.

Type: Pressure
Type: Crimp
Type: Threaded

Class: Insulated

Class: Non-insulated

Kind: Copper (for CU to Cu connection).

Style: Butt connection
Style: Elbow connection
Style: Combined "T" and straight connection
Style: "T" connection.
Style: Split-bolt parallel connection
Style: Tap connection
Style: Pigtail connection

D. 25KV Cable: Provide factory fabricated and tested primary service cable; underground residential distribution (URD) type cable, size #1/0 AWG solid aluminum conductor with 25KV cross-linked polyethylene insulation (XLP) with tinned or coated copper wire full size concentric neutral as approved by the Utility Company.

E. 25KV Terminations: Provide 25KV terminations for 25KV #1/0 AWG solid aluminum cable as approved by the Utility Company in quantities required by the Utility Company.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install electrical cables, wires and connectors, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices.

B. Coordinate cable and wire installation work with electrical raceway and equipment installation work, as necessary for proper interface. Pull conductors together where more than one is being installed in a raceway. Use pulling compound or lubricate, where necessary; compound must not deteriorate conductor or insulation. Use pulling means including fish tape, cable or rope which cannot damage raceway. Rope must be used as pulling means when pulling wires or cables into plastic conduit and duct. Keep conductor splices to a minimum and install in junction boxes only. No splices shall be permitted within conduit. Install splices and tapes which have mechanical strength and insulation rating equivalent or better than conductor. Use splice and tape connectors which are compatible with conductor material.

C. Installation of 25KV primary service cable with the Utility Company.

D. Deliver 25KV cable terminations to the Utility Company for installation and connection.

3.2 FIELD QUALITY CONTROL

A. Prior to energization, test cable and wire for continuity of circuitry and also for short circuits. Correct malfunctions when detected.

B. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements.

C. Test 25KV cable after installation using D.C. high potential (Hi-Pot) testing. All testing shall be performed in accordance with cable manufacturer's recommended specifications. Keep a complete record of all tests and submit to the Engineer upon completion. Testing shall be performed by an independent cable testing company or service.

END OF SECTION 260120

SECTION 260121

WIRE CONNECTIONS AND DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. This section is a Division 26 Basic Materials and Methods Section and is part of each Division 26 Section making reference to connectors and termination devices specified herein.

1.2 DESCRIPTION OF WORK

A. Extent of electrical connectors and termination work is indicated by drawings and specifications.

B. Types of connectors and termination devices in this section include, but are not limited to the following:

1. High voltage termination kits
2. Tap type connectors.
3. Split-bolt connectors.

C. Refer to other sections of Division 26 for, but not limited to, raceways, wires and cables used in conjunction with connectors and termination devices.

D. Applications for connectors and termination devices required for project are as follows unless otherwise indicated:

1. Primary distribution circuitry
2. Branch circuitry
3. Equipment circuitry
4. Control circuitry

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's data on electrical connectors, high voltage termination to the Engineer.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide connectors, high voltage terminations of one of the following manufacturers for each item used:

Burndy Corp.
Eagle Electric Mfg. Co., Inc.
Gould, Inc.
Ideal Industries, Inc.
Joslyn Mfg. and Supply Co.
O-Z/Gedney Co.

Pyle National Co.
Thomas and Betts Co.
Cooper Power Systems

2.2 CONNECTORS

A. Provide factory fabricated metal connectors of sizes, ratings, materials, types and classes as indicated for each service. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements and NEC standards.

Type: Pressure
Crimp
Threaded

Class: Insulated
Non-Insulated

Kind: Copper (for CU to Cu connection).

Style: Butt Connection
Elbow connection
Combined "T" and straight connection
"T" connection
Split-bolt parallel connection
Tap connection
Pigtail connection

2.3 HIGH VOLTAGE LOADBREAK ELBOW CONNECTORS

A. Furnish a one-piece, three phase, non-skirted, loadbreak elbow type rubber termination classified as ANSI/IEEE Standard 386 "200 AMP Loadbreak Interface No. 1, 8.3/14.4 KV, with the following characteristics:

1. Standard voltage class 15KV
2. Maximum rating phase to phase 14.4KV
3. Maximum rating phase to ground 8.3KV
4. AC 60 Hz. 1 minute withstand 34KV
5. DC 15-minute withstand 53KV
6. Bil and full wave crest 95KV
7. Minimum corona voltage level 11KV

B. Terminator shall be designed for three phase operation, fully shielded and submersible when mated with the proper components.

C. The high voltage terminator shall be detailed for terminating a solid dielectric shielded power cable rated 15KV, with a copper tap shield construction.

D. Terminator shall be a 200AMP, 15KV Class, loadbreak elbow connector with tape shield adapter, similar to Cooper Power Systems (RTE).

PART 3 – EXECUTION

3.1 600 VOLT CABLE CONNECTOR INSTALLATION

A. Install electrical connectors, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices.

B. Coordinate cable, wire and connector installation work with electrical raceway and equipment installation work, as necessary for proper interface. Pull conductors together where more than one is being installed in a raceway. Use pulling compound or lubricate, where necessary, compound must not deteriorate conductor of insulation, and must be in accordance with wire and cable manufacturer's recommendations. Use pulling means including fish tape, cable or rope which shall not damage raceways including plastic conduits and ducts.

3.2 HIGH VOLTAGE TERMINATION INSTALLATION

A. Install high voltage terminations in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices.

B. Coordinate terminations with cable, raceway and equipment installation work, as necessary for proper interface. Contractor shall coordinate termination kits with the size, type and style of high voltage cable being installed, in accordance with cable and termination manufacturer's written instructions and recommendations.

3.3 FIELD QUALITY CONTROL

A. Prior to energization, test cable and wire for continuity of circuitry and also for short circuits. Correct malfunctions when detected.

B. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements.

C. Test high voltage cable after installation using direct current high potential (Hi-Pot) testing. All testing shall be performed in accordance with cable manufacturer's recommended specifications. The Electrical Contractor shall keep a complete record of all tests and submit to the Engineer upon completion. All high voltage cable testing shall be performed by an independent cable testing company or service.

END OF SECTION 260121

SECTION 260135

ELECTRICAL BOXES & FITTINGS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. This section is a Division 26 Basic Materials and Methods section, and is a part of each Division 26 section making reference to electrical wiring boxes and fittings specified herein.

1.2 DESCRIPTION OF WORK

A. Types of electrical boxes and fittings in this section include the following:

Outlet boxes.
Junction boxes.
Pull boxes.
Conduit bodies.
Bushings.
Locknuts.
Knockout closures.

PART 2 – PRODUCTS

2.1 INTERIOR METALLIC OUTLET BOXES

A. Provide galvanized flat rolled sheet steel interior outlet non-gangable wiring boxes, of types, shapes and sizes, including box depths, to suit each respective location and installation; construct with stamped knockouts in back and sides and with threaded screw holes with corrosion-resistant screws for securing box covers and wiring devices.

B. Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used and fulfilling requirements of individual wiring situations. Choice of accessories is Installer's option.

C. Manufacturer: Subject to compliance with requirements, provide interior outlet boxes of one of the following:

Appleton Electric Co.
Bell Electric/Square D Co.
Pass and Seymour, Inc.
RACO, Inc.
Steel City/Midland-Ross Corp.

2.2 JUNCTION PULL BOXES

A. Provide galvanized code-gauge sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

B. Manufacturers: Subject to compliance with requirements, provide junction and pull boxes of one of the following:

Adalet-PLM Div., Scott and Fetzer Co.
Appleton Electric Co.
Arrow-Hart Div., Crouse-Hinds Co.
Bell Electric/Square D Co.
GTE Corporation
Keystone Columbia, Inc.
O-Z/Gedney Co.
Slater Electric Co.
Spring City Elect. Mfg. Co.

2.3 CONDUIT BODIES

A. Provide galvanized cast-metal conduit bodies, of types, shapes, and sizes, to suit respective locations and installation, construct with threaded-conduit-entrance ends, removable covers, and corrosion-resistant screws.

B. Manufacturers: Subject to compliance with requirements, provide conduit bodies of one of the following:

Appleton Electric Co.
Crouse-Hinds Co.
Gould, Inc.
Killark Electric Mfg. Co.
O-Z/Gedney Co.
Spring City Electrical Mfg. Co.

2.4 BUSHINGS, KNOCKOUT CLOSURES AND LOCKNUTS

A. Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and insulated malleable iron conduit bushings, offset connectors, of types and sizes to suit respective uses and installation.

B. Manufacturers: Subject to compliance with requirements, provide bushings, knockout closures, locknuts and connectors of one of the following:

Appleton Electric Co.
Burndy Corp.
Crouse-Hinds Co.
Gould, Inc.
O-Z/Gedney Co.
RACO, Inc.
Steel City/Midland-Ross Corp.
Thomas and Betts Co., Inc.

PART 3 – EXECUTION

3.1 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS

A. Install electrical boxes and fittings, complying with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work.

C. Provide weatherproof outlets for interior and exterior locations exposed to weather or moisture.

D. Provide knockout closures to cap unused knockout holes where blanks have been removed.

E. Install boxes and conduit bodies in those locations to ensure ready accessibility of electrical wiring.

F. Avoid using round boxes where conduit must enter box through side of box, which would result in difficult and insecure connections when fastened with locknut or bushing on rounded surface.

G. Fasten boxes rigidly to substrates or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.

H. Provide electrical connections for installed boxes.

I. Pull boxes and junction boxes shall be furnished and installed in all conduit runs at intervals not exceeding 100 feet maximum.

J. Identify each circuit in all pull boxes and junction boxes whether the box contains one or more circuits.

END OF SECTION 260135

SECTION 260160

PANELBOARDS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of panelboard load-center and enclosure work, including cabinets and cutout boxes, is indicated by drawings and schedules.

B. Types of panelboards and enclosures in this section include the following:

Lighting and Appliance Panelboards.
Distribution Panelboards.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's data including specifications, installation instructions and general recommendations, for each type of panelboard required. Include data substantiating that units comply with requirements.

B. Shop Drawings: Submit dimensioned drawings of panelboards and enclosures showing layouts of enclosures and required individual panelboard devices, including by not necessarily limited to, circuit breakers, contactors, and accessories, including wiring diagrams of contactors.

1.3 COORDINATION

A. The drawings are scheme and/or diagrammatic in nature, and indicate the need and intent of the design. These are to be used for general guidance only. It shall be the responsibility of the Electrical Contractor to coordinate, with other Division Subcontractors, the installation of all raceways, raceway supports, junction boxes and required fittings. This coordination will include conduit layout to allow access to equipment for maintenance.

B. This coordination shall be carried out prior to actual installation; this shall be done to eliminate the possibility of conflicts between trades on items such as access, clearances and maintenance issues that may arise after completion of construction.

C. Should the coordination not be carried out prior to installation, and a conflict exists, the installing contractor shall remove and reinstall the equipment as required to clear the conflict at no additional cost to the Owner and no delay in project completion.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type of panelboard and enclosure):
Cutler Hammer, Inc. (Eaton)
General Electric Company
Square D Company

Siemens

2.2 PANELBOARDS

A. General:

1. Panelboards shall comply with the following industry standards:

   a. UL Listing/Approval
   b. UL Standards:
      Panelboards - UL67
      Cabinet & Boxes - UL50
   c. National Electric Code
   d. NEMA Standard -PBI

2. Interiors:

   a. All interiors shall be completely factory assembled. They shall be so designed that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors, so that circuits may be changed without machining, drilling and tapping.

   b. Branch circuits shall be arranged using double row construction. A nameplate shall be provided listing panel type and rating.

   c. Unless otherwise noted, full size insulated neutral bars shall be included. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection. A ground bus will be included in all panelboards.

3. Boxes: Boxes shall be a minimum 20 inches wide and manufactured from galvanized steel. Provide minimum gutter space in accordance with the National Electric Code.

4. Trim:

   a. Switching device handles shall be accessible. Panel access doors shall not uncover any live parts. Doors shall have flush type cylinder lock and catch except doors over 48" in height shall have auxiliary fastenings top and bottom of door in addition to the flush type cylinder lock and catch. Panelboard trim clamps shall be of the indicating type. Upon removal of screws behind door, the panel interiors become service accessible via piano hinged trim front.

   b. Panel access door hinges shall be concealed. All locks shall be keyed alike; directory frame shall be welded metal and having a transparent cover shall be furnished with each door.

   c. All exterior and interior steel surfaces of the trim shall be properly cleaned, primed with a rust inhibiting phosphatized coating and finish with a gray ANSI 61 paint. Trims for flush panels shall overlap the box for a least 3/4 inch all around. Surface trims shall have the same width and height as the box. Trims shall be mountable by a screwdriver and without the need for special tools.

5. Main Bus and Branch Circuits: All main bus bars shall be full size aluminum, sized in accordance with U.L. standards to limit the temperature rise on any current carrying part to a maximum of 50 degrees C above an ambient of 40 degrees C maximum.

B. Distribution Panelboards:

1. Panels shall be provided with molded case circuit breakers tested and U.L. labeled per U.L. 489.

2. Circuit breakers 100 ampere through 400 ampere frame sizes shall be thermal-magnetic trip with inverse time current characteristics.

3. Where multiple pole circuit breakers are indicated, provide with common trip so overload on one pole will trip all poles simultaneously. Molded case circuit breakers shall have a minimum 22,000 symmetrical RMS interrupting capacity at 240 volts.

C. Lighting and Appliance Panelboards:

1. Provide switching and protective devices in quantities, ratings, types indicated, with anti-turn solderless pressure type lug connectors approved for copper conductors. Circuit breakers shall be the bolt-on, molded case, thermal magnetic type, with toggle handles that indicate when tripped. Where multiple pole circuit breakers are indicated, provide with common trip so overload on one pole will trip all poles simultaneously.

2. Panelboards for use at 240 volts AC maximum shall incorporate circuit breakers as shown rated at 10,000 A.I.C. symmetrical at 240 volts.

PART 3 – EXECUTION

3.1 INSTALLATION OF PANELBOARDS

A. Install panelboards and enclosures where indicated in contract documents and, in accordance with the equipment manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. Anchor enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secure.

C. Provide all required electrical and grounding connections within the panelboards and enclosures.

D. The Electrical Contractor shall furnish and install on the door within each enclosure, a circuit labeling identification system for all electrical panelboards. The system must satisfy the NEC Article No. 110-22. The directories shall be typed, NOT handwritten. As a minimum, the circuit labeling identification system shall include the following elements:

1. A door-mounted circuit directory that holds individual circuit cards for each pole space in the panelboard. The directory shall be properly sized for the panel to which it is attached.

END OF SECTION 260160

SECTION 260165

SWITCHBOARDS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of switchgear and switchboards is indicated by drawings and schedules.

B. Types of switchgear and switchboards in this section include the following: Dead-Front Switchboards.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's data on switchgear and switchboards.

B. Shop Drawings: Submit dimensioned drawings of switchgear and switchboards showing accurately scaled basic sections including, but not necessarily limited to, auxiliary compartments, section components, and combination sections.

1.3 COORDINATION

A. The drawings are scheme and/or diagrammatic in nature, and indicate the need and intent of the design. These are to be used for general guidance only. It shall be the responsibility of the Electrical Contractor to coordinate, with other Division Subcontractors, the installation of housekeeping equipment pad, switchboard cabinet structures, feeders, branch circuits, switchboard hardware and required fittings. This coordination will include conduit layout to allow access to equipment for maintenance.

B. This coordination shall be carried out prior to actual installation; this shall be done to eliminate the possibility of conflicts between trades on items such as access, clearances and maintenance issues that may arise after completion of construction.

C. Should the coordination not be carried out prior to installation, and a conflict exists, the installing contractor shall remove and reinstall the equipment as required to clear the conflict at no additional cost to the Owner and no delay in project completion.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

Dead-Front Switchboards
- Cutler Hammer, Inc. (Eaton)
- General Electric Co.
- Square D Co.
- Siemens

2.2 EQUIPMENT AND COMPONENTS

A. Furnish the service entrance switchboard as indicated in contract documents. The switchboard shall meet the latest requirements of Underwriters Laboratories' Standard No. 891, NEMA PB2 and the National Electric Code. The switchboard shall be furnished with an Underwriters Laboratories' label.

B. Enclosure Construction: The switchboard shall be deadfront with front accessibility required. The switchboard frame shall be of formed code gauge steel rigidly welded and bolted together to support all coverplates, bussing and component devices during shipment and installation. Steel base channels shall be bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting. Each switchboard section shall have an open bottom and an individually removable top plate for installation and termination of conduits. The switchboard enclosure shall be painted on all exterior and interior surfaces. The paint finish shall be a meduim light gray, ANSI #49, applied by the electro-deposition process over an iron phosphate pre-treatment. All front covers shall be screwed on and removable and all doors shall be hinged with removable hinge pins. Top and bottom conduit areas shall be clearly indicated on shop drawings.

C. Bussing: The switchboard bussing shall be of a sufficient cross-sectional area to meet U.L. Standard 891 temperature rise. Through bus shall be extruded aluminum plated by the Alstan 70 process. The through bus shall have an ampacity where indicated on the single line riser diagram and shall be rated to withstand a short circuit current rating of 50,000 RMS symmetrical ampers. The through bus supports, connections and joints are to be bolted with hex-head bolts and belleville washers to minimize maintenance requirements and shall have provisions for the addition of future sections.

D. Short Circuit Current Rating: Each switchboard, as a complete unit, shall be given a single short circuit current rating by the manufacturer in accordance with U.L. specifications, on equipment constructed similarly to the subject switchboard.

E. Main Circuit Breaker: The service disconnect device shall be a molded case circuit breaker totally front accessible and front connectable. The circuit breaker shall be provided with ground fault protection.

F. Branch Circuit Breakers: Group mounted molded case circuit breakers shall be totally front accessible. The circuit breakers shall be mounted in the switchboard to permit installation, maintenance and testing without reaching over any line side bussing. The circuit breakers are to be removable by the disconnection of only the load side cable terminations and all line and load side connections are to be individual to each circuit breaker. No common mounting brackets or electrical bus connectors will be acceptable.

G. Main switchgear shall be furnished with a phase loss relay with a set of contacts to send a trouble alarm to existing security control panel. Unit shall be furnished, installed and wired by equipment manufacturer. All other wiring required for proper interface to security control panel shall be by the Electrical Contractor. Coordinate all work and provide all required wiring as directed by Owner’s local security system representative.

PART 3 – EXECUTION

3.1 INSTALLATION OF SWITCHGEAR AND SWITCHBOARDS

A. Install switchgear and switchboards where shown, in accordance with manufacturer's written instructions, with recognized industry practices to ensure that switchgear and switchboards comply with requirements of NEMA and NEC Standards, and applicable portions of NECA's "Standard of Installation".

B. Tighten electrical bus connections and mechanical fasteners.

C. Provide connections within switchboard.

3.2 ADJUST AND CLEAN

A. Adjust operating mechanisms for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finish.

3.3 FIELD QUALITY CONTROL

A. Prior to energization of switchboards, check with ground resistance tester phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.

B. Prior to energization, check switchboards for electrical continuity of circuits, and for short circuits.

C. Subsequent to wire and cable hook-ups, energize switchboards and demonstrate functioning in accordance with requirements.

END OF SECTION 260165

SECTION 260170

MOTOR AND CIRCUIT DISCONNECTS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of motor and circuit disconnect switch work is indicated by drawings and schedules.

B. Types of motor and circuit disconnect switches in this section include the following:

Equipment disconnects.
Appliance disconnects.
Motor-circuit disconnects.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's data including specifications, installation instructions and general recommendations, for each type of motor and circuit disconnect switch required.

1.3 COORDINATION

A. The drawings are scheme and/or diagrammatic in nature, and indicate the need and intent of the design. These are to be used for general guidance only. It shall be the responsibility of the Electrical Contractor to coordinate, with other Division Subcontractors, the installation of all motor and circuit disconnect switches, supporting hardware, including wiring and conduit, to and from the equipment. This coordination will include conduit layout to allow access to equipment for maintenance.

B. This coordination shall be carried out prior to actual installation; this shall be done to eliminate the possibility of conflicts between trades on items such as access, clearances and maintenance issues that may arise after completion of construction.

C. Should the coordination not be carried out prior to installation, and a conflict exists, the installing contractor shall remove and reinstall the equipment as required to clear the conflict at no additional cost to the Owner and no delay in project completion.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following (for each type of switch):

Cutler-Hammer, Inc. (Eaton)
General Electric Co.
Square D Company
Siemens

2.2 FABRICATED SWITCHES

A. Safety Switches: Safety switches shall be of sizes noted on the drawings, fusible or non-fusible and contained in a general purpose enclosure. All switches shall be type HD and have quick-make, quick- break operation. All switches shall be of proper horsepower rating as applicable and have dual interlocks designed to interlock the switch box door with the switch operating mechanism. Unit shall be provided with a suitable means of interlock release. An arrangement shall be provided for locking the operating handle in the "ON" or "OFF" position. Safety switches shall have the proper type metal enclosure, i.e., standard, weatherproof, etc., to suit their specific location as required by the National Electrical Code.

B. Fuses: Provide fuses for safety switches, as recommended by switch manufacturer, of classes, types and ratings needed to fulfill electrical requirements for service indicated.

C. When packaged rooftop equipment is furnished, the unit disconnect switch shall be furnished, mounted and wired by the installing contractor.

D. When rooftop exhaust fans rated less than 1/2 HP at 120 volts, single phase, are furnished, except utility sets, the unit disconnect switch shall be furnished, mounted and wired by the installing contractor.

PART 3 – EXECUTION

3.1 INSTALLATION OF MOTOR AND CIRCUIT DISCONNECT SWITCHES

A. Install motor and circuit disconnect switches where indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products fulfill requirements.

B. Install disconnect switches used with motor-driven appliances, and motors and controllers within sight of controller position unless otherwise indicated.

C. Provide electrical connections for motor and circuit disconnect switches.

END OF SECTION 260170

SECTION 260180

OVERCURRENT PROTECTIVE DEVICES

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of overcurrent protective device work is indicated by drawing schedules and specifications.

B. Types of overcurrent protective devices in this section include the following:

1. Service entrance rated disconnect.
2. Molded case circuit breaker.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's data on overcurrent protective devices, including: voltages and current ratings, interrupting ratings, current limitations, internal inductive and non-inductive loads, time-current trip characteristic curves, and mounting requirements.

B. Shop Drawings: Submit layout drawings of overcurrent protective devices, showing spatial relationships of units to associated electrical equipment, and connections to electrical power supplies.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

1. Circuit-Breakers

Cutler-Hammer, Inc. (Eaton)
General Electric Co.
Square D Co.
Siemens

2.2 CIRCUIT BREAKERS

A. Except as otherwise indicated, provide circuit breakers and ancillary components, of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information, as required for a complete installation.

B. Service Entrance Rated Disconnect: The service disconnect device shall be a molded-case circuit breaker totally front accessible and front connectable. The circuit breaker shall be a three pole device suitable for operation on a 240 volt, 60 Hertz system. Circuit breaker shall have 22,000

RMS symmetrical amperes interrupting rating, and shall be UL approved for Service Entrance equipment.

C. Molded-Case Circuit Breakers: Provide factory assembled, molded-cased circuit breakers of frame size indicated; 120/208 volts, 60 Hertz, one, two, or three poles with a short circuit symmetrical ampere interrupting rating as indicated by the panel schedule and/or as shown by the single line riser diagram. Provide circuit breakers with permanent thermal instantaneous magnetic trips in each pole with ampere ratings as indicated. Construct with overcenter, trip-free, toggle type operating mechanisms with quick-make, quick- break action and positive handle trip indication. Construct devices for mounting and operating in any physical position and operating in an ambient temperature of 40 degrees C. Provide circuit breakers with mechanical screw type connector lugs, AL/CU rated.

PART 3 – EXECUTION

3.1 INSTALLATION OF OVERCURRENT PROTECTIVE DEVICES

A. Install overcurrent protective devices as indicated in contract documents, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC Standards for Installation of overcurrent protective devices.

B. Coordinate with other work, including electrical wiring work, as necessary to interface installation of overcurrent protective devices with other work.

C. Fasten circuit breakers without causing mechanical stresses, twisting or misalignment being exerted by clamps, supports, or cabling.

3.2 ADJUST AND CLEAN

A. Inspect circuit-breaker operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

3.3 FIELD QUALITY CONTROL

A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry, and for short-circuits. Correct malfunctioning units, and then demonstrate compliance with requirements.

END OF SECTION 260180

SECTION 260190

SUPPORTING DEVICES

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Types of supports, anchors, sleeves and seals specified in this section include the following:
Hangers.
Riser Clamps.
C-clamps
I-beam clamps.
One-hole conduit straps.
Two-hole conduit straps.
Round steel rods.
Lead expansion anchors.
Toggle bolts.
U-Channel Strut Systems.

PART 2 – PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES

A. Provide supporting devices, complying with manufacturer's standard materials, design and construct in accordance with published product information, and as required for a complete installation, and as herein specified.

B. Supports: Provide supporting devices of types, sizes and materials having the following construction features:

Hangers: For supporting EMT conduit, electro-galvanized steel, with 1/4" minimum diameter hole for round steel rod; approximately MSS types 5, 7, 9 or spring steel conduit clips.

Reducing Couplings: Steel rod reducing coupling, 1/4" minimum black steel.

C-Clamps: Black malleable iron, 1/4" minimum rod size.

I-Beam Clamps: Black steel, 1-1/4" x 3/16" stock; 3/8" cross bolt; flange width 2"; approx. 52 pounds per 100 units.

One-Hole Conduit Straps: For supporting EMT conduit, electro- galvanized steel.

Two-Hole Conduit Straps: For supporting EMT conduit, electro-galvanized steel; 3/4" strap width; and 2-1/8" between center of screw holes.

Hexagon Nuts: For 1/4" rod size; galvanized steel.

Round Steel Rod: Black steel; 1/4" min. dia.

Offset Conduit Clamps: For supporting rigid metal conduit; black steel.

C. Anchors: Provide anchors of types, sizes and materials indicated; and having the following construction features:

Lead Expansion Anchors: 1/4" - 20 Minimum.

Toggle Bolts: Springhead; 3/16 x 4".

D. Manufacturer: Subject to compliance with requirements, provide anchors of the following:

Ackerman Johnson Fastening Systems, Inc.
Elcen Metal Products Co.
Ideal Industries, Inc.
Rawlplug Co., Inc.
Star Expansion Co.
U.S. Expansion Bolt Co.
Erico Products, Inc. (Caddy)

E. U-Channel Strut Systems: Provide U-channel strut system for supporting electrical equipment, 16-gauge hot dip galvanized steel, construct with 9/16" dia. holes, 8" o.c. on top surface, with standard hot dip galvanized finish, and with the following fittings which mate and match with U-channel.

Beam clamps.
Thinwall conduit clamps.
Conduit hangers.
U-bolts.

F. Manufacturers: Subject to compliance with requirements, provide channel systems of one of the following:

B-Line Systems, Inc.
Elcen Metal Products Co.
Power-Strut Div.; Van Huffel Tube Corp.
Unistrut Div.; GTE Products Corp.

PART 3 – EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES

A. Install hangers and anchors in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA, NEC and ANSI/NEMA for installation of supporting devices.

B. Install hangers, supports, clamps and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with maximum spacings.

END OF SECTION 260190

SECTION 260400

ELECTRICAL DISTRIBUTION

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.

B. This section is a Division 26 Basic Methods and Materials Section, and is part of each Division 26 Section.

1.2 DESCRIPTION

A. Perform all work necessary and/or required and furnish all materials and equipment for a complete system of electrical service and distribution. Such work includes but is not limited to the following:

1. Existing 120/208 volt, 3 phase, 4 wire grounded neutral service to be utilized for this project distribution.

2. Grounding system for the electric service entrance, equipment and the distribution system.

3. Complete system of distribution for light and power including panelboard and circuit breakers, switches, receptacles, wiring devices, conduit and wiring.

1.3 SHOP DRAWINGS

A. No shop drawing submittals required under this specification section.

1.4 ELECTRICAL SERVICE

A. Main incoming secondary service shall be 120/208 volt, 3 phase, 4 wire, grounded neutral (wye).

1.5 ELECTRIC DISTRIBUTION SYSTEM

A. 120/208 volt, 3 phase, 4 wire grounded neutral system for 120/208 volt combined lighting and power.

PART 2 – PRODUCTS

2.1 GROUNDING

A. Grounding shall comply with the requirements of the National Electrical Code with all final grounds being made to the driven ground rod(s). System neutrals to be grounded to one location only for protective relaying.

B. The following list is representative of the parts which shall be solidly grounded:

Electric systems neutrals
Electric systems grounding conductors
Conduit system complete

Panelboard
Equipment frames, boxes and cabinets

PART 3 – EXECUTION

3.1 ELECTRIC DISTRIBUTION SYSTEM

A. Install the main feeders and sub-feeders using specified conductors in electrical raceways.

3.2 GROUNDING

A. Provide a complete grounding system for the electrical systems, equipment frames and housing.

B. Contractor shall make such connections as are necessary and shall be required to complete the wiring arrangement shown on the single line wiring diagram on drawings.

END OF SECTION 260400

SECTION 260402

UNDERGROUND ELECTRIC SERVICE

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Underground electric service work is indicated by drawings and schedules.

B. Types of underground electric service equipment in this section includes the following:

Raceways
Cable and Wire
Wall and Floor Seals

PART 2 – PRODUCTS

2.1 SERVICE ENTRANCE EQUIPMENT

A. Provide Service Entrance equipment accessories, of the types, sizes, ratings and electrical characteristics which comply with manufacturer's standard materials, design and construction in accordance with published product information and as required for complete installation, and as herein specified.

2.2 OVERCURRENT PROTECTIVE DEVICES

A. Provide overcurrent protective devices complying with Division 26 Basic Materials and Methods Section "Overcurrent Protective Devices", in accordance with the following listing:

Service Entrance rated disconnect.
Molded-case circuit breakers.

2.3 CABLE/WIRING

A. Provide cable/wiring complying with Division 26 Basic Materials and Methods Section "Wires and Cables", in accordance with the following listing:

Type THW, Copper Cable.
Type THW, Aluminum Cable.

2.4 RACEWAYS

A. Provide raceways complying with Division 26 Basic Materials and Methods Section "Raceways", in accordance with the following listing:

Intermediate metal conduit and fittings.
Rigid metal conduit and fittings.
Polyvinyl chloride rigid conduit (Exterior Only).

2.5 SERVICE ENTRANCE ACCESSORIES

A. Provide wall and floor seals complying with Division 26 in accordance with the following listing:

Wall and floor seals

PART 3 – EXECUTION

3.1 INSTALLATION OF UNDERGROUND ELECTRIC SERVICE EQUIPMENT

A. Install underground electric service equipment in accordance with equipment manufacture's written instructions, and with recognized industry practices, to ensure that Service Entrance equipment fulfills requirements. Comply with applicable installation requirements of NEC and NEMA Standards.

B. Coordinate with other electrical work, including Utility Company wiring, as necessary to interface installation of Service Entrance equipment work with other work.

3.2 GROUNDING

A. Provide tight system and equipment grounding and bonding connections for Service Entrance equipment and wiring/cabling.

3.3 FIELD QUALITY CONTROL

A. Upon completion of installation of underground electric service equipment and electrical circuitry, energize circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

END OF SECTION 260402

SECTION 260430

METERING EQUIPMENT

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of circuit monitoring equipment work is indicated by drawings and schedules. Circuit monitoring equipment is defined as a single discrete unit attached to the Electrical Distribution System which is intended to furnish read-outs of electrical energy consumption.

B. Types of electrical circuit monitoring equipment in this section include the following:

Digital Circuit Monitoring Package

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's data on a complete digital metering package, including but not limited to, wiring diagrams.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

General Electric Company: Power Leader.
Square D Company: Powerlogic.
Westinghouse Electric Corporation: IQ Data
Siemens

2.2 EQUIPMENT

A. Furnish in a surface mounted, general purpose, NEMA 1 enclosure, a microprocessor based digital circuit monitoring package complete with required current transformers sized to match main circuit breaker rating.

B. Unit shall provide the following direct reading metered values:

1. A.C. Amperes: 1% Accuracy, Phase A, Phase B, Phase C.
2. A.C. Voltage: 1% Accuracy, Phase A-B, Phase B-C, Phase C-A Phase A-N, Phase B-N, Phase C-N
3. Watts: 2% Accuracy.
4. Vars: 2% Accuracy.
5. Power Factor: 4% Accuracy.
6. Frequency: 0.5% Accuracy.
7. Watt Demand: 2% Accuracy.
8. Watthours: 2% Accuracy.
9. Temperature: 2% Accuracy.

C. Unit shall retain the peak demand value and shall automatically reset when the building sets a new peak demand value.

PART 3 – EXECUTION

3.1 INSTALLATION OF METERING EQUIPMENT

A. Install circuit monitoring equipment devices in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that the metering equipment complies with the requirements of the project.

3.2 ADJUST AND CLEAN

A. Inspect circuit monitoring equipment for malfunctioning and, where necessary, adjust equipment.

3.3 FIELD QUALITY CONTROL

A. Prior to energization of the circuit monitoring equipment, test equipment for continuity of circuitry and for short-circuits. Adjust or correct malfunctioning equipment, and then demonstrate compliance with project requirements.

END OF SECTION 260430

SECTION 260452

GROUNDING

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Types of grounding in this section include the following:

Grounding:

Underground metal piping.
Underground metal water piping.
Grounding rods.
Service equipment.
Enclosures.
Systems.
Equipment.
Building Structural Steel (Bonding)

PART 2 – PRODUCTS

2.1 GROUNDING

A. Except as otherwise indicated, provide each electrical grounding system indicated, with assembly of materials including, but not necessarily limited to, cables/wires, connectors, terminals (solderless lugs), and other items and accessories needed for complete installation. Where materials or components are not otherwise indicated, comply with NEC, NEMA, and established industry standards for applications indicated.

B. Provide conduit, tube, duct, cable and fittings complying with Division 26 Basic Materials and Methods section, "Raceways", in accordance with the following listing:

Rigid steel conduit.
Electrical metallic tubing.
Flexible metal conduit.
Liquid-tight flexible metal conduit.
Rigid metal conduit fittings.
EMT fittings.
Flexible metal conduit fittings.
Liquid-tight flexible metal conduit fittings.

2.2 ELECTRICAL GROUNDING CONDUCTORS

A. Unless otherwise indicated, furnish a green insulated equipment grounding conductor for all feeders and branch circuits, matching power supply wiring materials and sized according to NEC.

2.3 BONDING PLATES, CONNECTIONS, TERMINALS & CLAMPS

A. Provide electrical bonding plates, connectors, terminals and clamps as recommended by bonding plate, connector, terminal and clamp manufacturers for applications.

2.4 GROUND RODS & PLATES

A. Ground Rods: Steel with copper welded exterior, 3/4" dia. x 10'.

PART 3 – EXECUTION

3.1 INSTALLATION OF GROUNDING SYSTEMS

A. Install electrical grounding systems in accordance with manufacturer's written instructions and with recognized industry practices to ensure grounding complies with requirements. Comply with requirements of NEC, NESC, NEMA and UL standards for installation of grounding systems.

B. Coordinate with other electrical work as necessary to interface installation of grounding system with other work.

C. Clamp cable connections to ground rods.

D. Install bonding jumpers with ground clamps on water meter piping to electrically bypass water meter.

E. Install clamp-on connectors only on thoroughly cleaned metal contact surfaces, to ensure electrical conductivity and circuit integrity.

3.2 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical grounding system, test ground resistance with ground resistance tester. Where tests show resistance-to-ground is over 25 ohms, take appropriate action to reduce resistance to 25 ohms or less by driving additional ground rods and/or by chemically treating soil encircling ground rods with sodium chloride, calcium chloride, copper sulphate, or magnesium. Then retest to demonstrate compliance.

END OF SECTION 260452

SECTION 260470

DISTRIBUTION CIRCUITS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Distribution circuit work is indicated by drawings and schedules.

B. The distribution circuits shall include furnishing and installing a complete wire and conduit system between distribution panelboards and branch circuit panelboards.

C. Types of equipment to be furnished and installed in this section include the following:

Rigid Metal Conduit
Intermediate Metal Conduit (IMC)
Electrical Metallic Tubing (EMT)
PVC (Below Slab Only)
Wires and Cables
Junction Boxes
Pull Boxes
Conduit Bodies
Bushings
Locknuts
Supporting Devices

PART 2 – PRODUCTS

2.1 DISTRIBUTION CIRCUITS

A. Furnish and install each distribution circuit indicated, with assembly of materials, including but not necessarily limited to, conduit, wire, pull boxes, junction boxes and other items and accessories needed for a complete installation. Where materials or components are not otherwise indicated, comply with NEC, NEMA and established industry standards for applications indicated.

PART 3 – EXECUTION

3.1 INSTALLATION OF DISTRIBUTION CIRCUITS

A. Install distribution circuits complying with equipment manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation", and in accordance with recognized industry practices.

B. Multiple circuits within a single raceway shall not be permitted under this section.

END OF SECTION 260470

SECTION 260471

FEEDER CIRCUITS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Feeder circuit work is indicated by drawings and schedules.

B. The feeder circuits shall include furnishing and installing a complete wire and conduit system between distribution panelboards and major 3 phase loads, between power panels and 3 phase motor loads.

C. Types of equipment to be furnished and installed in this section include the following:

Rigid Metal Conduit
Electrical Metallic Tubing (EMT)
Intermediate Metal Conduit (IMC)
Wires and Cables
Junction Boxes
Pull Boxes
Conduit Bodies
Bushings
Locknuts
Supporting Devices

PART 2 – PRODUCTS

2.1 FEEDER CIRCUITS

A. Furnish and install each feeder circuit with assembly of materials, including but not necessarily limited to, conduit, wire, pull boxes, junction boxes and other items and accessories needed for a complete installation. Where materials or components are not otherwise indicated, comply with NEC, NEMA and established industry standards for applications indicated.

PART 3 – EXECUTION

3.1 INSTALLATION OF FEEDER CIRCUITS

A. Install feeder circuits, complying with equipment manufacturer's written instructions, applicable requirements of NEC, NEMA and NECA's "Standard of Installation", and in accordance with recognized industry practices.

B. Multiple circuits within a single raceway shall not be permitted under this section.

END OF SECTION 260471

SECTION 260472

BRANCH CIRCUITS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Branch circuit work is indicated by drawings.

B. The branch circuits shall include furnishing and installing a complete wire and conduit or cable system between panelboards and lighting fixtures, receptacles, fractional horsepower motors, and small single phase loads.

C. Types of equipment to be furnished and installed in this section include the following:

Rigid Raceways – See Section 260110
Electrical Metallic Tubing (EMT)
Wires and Cables
Junction Boxes
Pull Boxes
Conduit Bodies
Bushings
Locknuts
Supporting Devices

PART 2 – PRODUCTS

2.1 BRANCH CIRCUITS

A. Furnish each branch circuit with an assembly of materials, including but not necessarily limited to, conduit, wire, cable, pull boxes, junction boxes and other items and accessories needed for a complete installation. Where materials or components are not otherwise indicated, comply with NEC, NEMA and established industry standards for applications indicated.

2.2 CONVENIENCE BRANCH CIRCUITS

A. Intent:

1. The intent of this portion of the specifications is to describe the requirements of a convenience circuit as it applies to 120-volt receptacles.

2. All convenience branch circuits may consist of more than one 120 volt receptacle.

B. Convenience Circuit - General: A circuit consisting of a phase and neutral conductor, which may share its neutral with other phase conductors provided that the neutral conductor does not become overloaded due to circuit phase relationship. This type of circuit shall also include an equipment grounding conductor as described under the grounding section of the specifications.

C. Convenience Circuit - Dedicated: A circuit consisting of a phase and neutral conductor which DOES

NOT share conductors with any other circuits. This type of circuit shall also include an equipment grounding conductor as described under the grounding section of the specifications.

PART 3 – EXECUTION

3.1 INSTALLATION OF BRANCH CIRCUITS

A. Install branch circuits, complying with equipment manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation", and in accordance with recognized industry practices.

B. Multiple circuits within a single raceway or cable shall be permitted under this section. It shall be the responsibility of the Electrical Contractor to assure that the neutral conductors do not become overloaded due to circuit phase relationship, and isolated grounds not become voided or compromised due to miswiring or wrong connections.

C. The Electrical Contractor may elect to use metal clad cable in lieu of electrical metallic tubing (EMT) in wall cavities, and/or above tile or dry wall ceilings. In all areas of exposed construction, electrical metallic tubing (EMT) shall be installed.

END OF SECTION 260472