PROJECT MANUAL

FOR

CHESTER UPLAND SCHOOL DISTRICT

Main Street School
Cafeteria HVAC Improvements

Prepared By: MGE Associates

DECEMBER 23, 2024

NOTICE OF ADVERTISEMENT FOR BIDS:

1. **CUSD – MAINSTREET SCHOOL CAFETERIA HVAC IMPROVEMENTS**
2. **CUSD – CHEERLEADER LOCKER ROOM RENOVATIONS**

Public notice is given that sealed bids/proposals will be received online via the PennBid Program by Chester Upland School District by January 21, 2024 until 4:00 PM prevailing time.

CUSD – Mainstreet School Cafeteria HVAC Improvements – The scope of work includes installation of a new HVAC (DX and Gas, mounted on grade) unit to serve the cafeteria at the Mainstreet School. Additional improvements include a window unit in the Annex and incidental electrical upgrades.

CUSD – Cheerleader Locker Room Renovations – The scope of work includes renovations to the Cheerleader Locker Room to include, upgraded flooring, ceiling grid, lighting, counters, painting, and lockers.

There will be a mandatory walk-through on Wednesday, January 8, 2024 at 10:00 AM. Interested proposers will meet at Chester High School, 232 W. 9th Street, Chester, PA 19013.

Bidders are required to submit a surety in the form of a bond or equivalent meeting 10% of the overall bid price in compliance with the contract documents. Bid bonds will be returned to the non-awarded bidders upon the execution of the contract. The successful Bidder shall also be required to provide a Performance Bond in an amount of one hundred percent (100%) of the Contract amount within ten (10) calendar days of receipt of written notice of acceptance of the Bid.

There is no physical public bid opening for this project, bids will be revealed via the PennBid website.

The Successful Bidder Who Is Awarded The Contract, Will Be Required To Pay "PennBid" A Fee Of 0.0033% (⅓ of 1 percent) up to $5,000 Of The Contract Award Value.

All interested parties must submit questions via PennBid website (https://pennbid.bonfirehub.com.com/login) by the posted deadline. Bidders are not permitted to contact the staff directly.

The contract is subject to PA Procurement Rules which include Prevailing Wage Requirements.

The Contract Documents contain all pertinent regulations. Award of the contract will be to the lowest responsible bidder. The Owner reserves the right to reject any or all bids or to accept any portion of any bid, and to award Contracts as is deemed best for the Owner.

PROPOSERS ARE REQUIRED TO READ THE ENTIRE SOLICITATION, INCLUDING ALL REFERENCED DOCUMENTS, ASSURE YOU THAT THEY ARE WILLING AND ABLE TO COMPLY, AND INCORPORATE ALL ASSOCIATED COSTS IN THEIR PROPOSAL.

Receiver Nafis Nichols
Chester Upland School District

Advertised in the Delaware County Times:
Thursday, December 26, 2024 and Monday, December 30, 2024

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PROCUREMENT AND CONTRACTING REQUIREMENTS

NOTICE TO CONTRACTORS

Sealed proposals for the CUSD Main Street School Cafeteria HVAC Improvements will be received electronically via the PennBid Program by the Chester Upland School District until January 21, 2024 until 4:00 PM prevailing time, at which time said bids will be publicly opened with the results made available via PennBid.

Plans, Specification, and bid forms may be obtained at no cost on PennBid (https://pennbid.bonfirehub.com.com/login)

Each bid must be accompanied by either a bid bond in an amount of ten (10%) of the bid amount from a surety satisfactory to the District or by certified check or letter of credit upon a solvent bank in the amount of ten (10%) of the bid amount in favor of the District. Bid Bonds shall be accompanied by Proof of Authority of the official or agent signing the bond.

Attention of bidders is called to all of the requirements contained in this bid packet, particularly to the application of the PA Prevailing Wage Requirements, various insurance requirements, various equal opportunity provisions, and the requirement of a payment bond and performance bond for 100% of the contract price.

All prospective bidders are required to present proof of an acceptable disposal method approved by the Pennsylvania Department of Environmental Resources or counterpart Agency in another State. The proof may consist of a copy of a State Solid Waste Disposal Permit to the prospective bidder or a Letter of Approval for the use of a proposed or existing disposal facility which has a permit or is under review for a permit.

The contract is subject to PA Procurement Rules which include Prevailing Wage Requirements.

Attention is called to the fact that the Contractor must ensure that employees and applicants for employment are not discriminated against because of their race because of their race, color, religion, sex, handicap, familial status, or national origin. Hearing impaired individuals may contact the District through the AT&T Relay Center at 1-800-654-5984.

No bidder may withdraw his bid within sixty (60) days after the actual date of the opening thereof. Chester Upland School District reserves the right to waive any informalities or to reject any or all bids.

NONCOLLUSION AFFIDAVIT

State of

BID Identification: CUSD Main Street School Cafeteria HVAC Improvements

CONTRACTOR _____, being first duly sworn, deposes and says that he is _____(sole owner, a partner, president, secretary, etc.) of the party making the foregoing BID; that such BID is not made in the interest of or on behalf of any undisclosed person, partnership, company, association, organization, or corporation; that such BID is genuine and not collusive or sham; that said BIDDER has not directly or indirectly induced or solicited any other BIDDER to put in a false or sham BID, and has not directly or indirectly colluded, conspired, connived, or agreed with any BIDDER or any one else to put in a sham BID, or that any one shall refrain from bidding; that said BIDDER has not in any manner, directly or indirectly, sought by agreement, communication or conference with any one to fix the BID price of said BIDDER or of any other BIDDER, or to fix any overhead, profit, or cost element of such BID price, or of that of any other BIDDER, or to secure any advantage against the OWNER awarding the contract or anyone interested in the proposed contract; that all statements contained in such BID are true; and, further, that said BIDDER has not, directly or indirectly, submitted his BID price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid and will not pay any fee in connection therewith, to any corporation, partnership, company, association, organization, BID depository, or to any member or agent thereof, or to any other individual except to such person or persons as have a partnership or other financial interest with said BIDDER in his general business.

Signed:

_____

Subscribed and sworn to before me this _____ day of _____, 20___.

Seal of Notary

_____

BID BOND

KNOW ALL MEN BY THESE PRESENTS, THAT WE, as PRINCIPAL, and _____ as SURETY, are held and firmly bound unto the (hereinafter called the OWNER), in the penal sum of DOLLARS ($_____) lawful money of the United States, for payment of which sum well and truly to be made, we bond ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THE OBLIGATION IS SUCH that whereas the Principal has submitted the accompanying Bid dated _____ for .

NOW, THEREFORE, if the Principal shall not withdraw said Bid within the time specified therein after the opening of the same, and shall within ten (10) days after the Principal is notified by the Owner of the award of such Contract to him, enter into a written contract with the Owner, in accordance with the Bid as accepted; and give bond with good and sufficient surety or sureties as may be required for the faithful performance and proper fulfillment and labor supplied, if required in said Contract; or in event of the withdrawal of said Bid within the period specified, or the failure to enter into such Contract and give such bonds within the time specified if the Principal shall pay the Owner the difference between the amount specified in said Bid and the amount for which the Owner may procure the required materials or supplies, or both, if the latter amount of the former, together with any other expenses and costs that may have been incurred by the Owner, then the above obligation shall be void and of no effect, otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above bonded parties have executed this instrument under their several seals this _____ day of _____, 20____, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

WITNESSED BY:

_____
(Individual Principal)

Business Address:

ATTEST:

_____
Corporate Principal

Corporate Surety

By:

SEAL

(Power of Attorney for person signing for Surety Company must be attached to bond.)

INSTRUCTIONS TO BIDDERS

1. RECEIPT AND OPENING OF BIDS: Chester Upland School District (herein called the "Owner"), invites bidders to submit sealed bids that will be received online via the PennBid Program by the Chester Upland School District by January 21, 2024, 4:00 PM prevailing time. There is no physical bid opening for this project, bids will be revealed via the PennBid website.

   A uniform fee of 0.333% (1/3 of 1 percent) of the bid amount (up to $5,000.00) is applied only to bidders who area awarded contracts. No fees apply to bidders who submit without being awarded the contract.

   The Owner may consider informal any bid not prepared and submitted in accordance with the provisions hereof and may waive any informalities or reject any and all bids. Any bid may be withdrawn prior to the above scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified shall not be considered. No bidder may withdraw a bid within thirty (30) days after the actual date of the opening thereof.

2. PREPARATION OF BID: Each bid must be submitted electronically via PennBid, on the prescribed form and accompanied by a Bid Bond, Certified Check, or Letter of Credit, the Non-collusion Affidavit, and Subcontractor Declaration Form. All blank spaces for bid prices must be completed, in ink or typewritten, in both words and figures, and the foregoing Certifications must be fully completed and executed when submitted. In case of discrepancies of written words and figures, the prices written in words shall govern.

   All bids will be received through the PennBid Program and bidder shall adhere to requirements detailed on the Bid located on the website.

3. MODIFICATION OF BIDS: Any bidder may modify his/her bid within PennBid at any time prior to the due date and time listed in the invitation to bid.

4. METHOD OF BIDDING: The Owner invites unit price/lump sum price bids as indicated in the Bid Form.

   If the lowest total responsive bid received exceeds the amount of funds available to finance the contract, the Owner may:

   a. Reject all bids;

   b. Augment the funds available in an amount sufficient to enable award to the lowest responsive bidder or bidders;

c. Take the base bid less the alternative deductible (if any) as listed on the proposal form as to produce a net amount which is within available funds.

5. QUALIFICATIONS OF BIDDER: The Owner may make such investigations as he/she deems necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligations of the contract and to complete the work contemplated therein. Conditional bids will not be accepted.

6. BID SECURITY: Each bid must be accompanied by cash, certified check of the bidder, or a bid bond prepared on the form of bid bond attached hereto, duly executed by the bidder as principal and having as surety thereon a surety company approved by the Owner. Such cash, checks or bid bonds will be returned to all except the three lowest bidders within three days after the opening of bids, and the remaining cash, checks or bid bonds will be returned promptly after the Owner and the accepted bidder have executed the contract, or, if no award has been made within thirty (30) days after the date of the opening of bids, upon demand of the bidder at any time thereafter, so long as he/she has not been notified of the acceptance of his/her bid. Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

7. LIQUIDATED DAMAGES FOR FAILURE TO ENTER INTO CONTRACT: The successful bidder, upon his/her failure or refusal to execute and deliver the contract and bonds required within ten (10) days after he/she has received notice of the acceptance of his/her bid, shall forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposited with his/her bid.

8. CONDITIONS OF WORK: Each bidder must inform himself/herself fully to the conditions relating to the construction of the project and the employment of labor thereon. Failure to do so will not relieve a successful bidder of his/her obligation to furnish all material and labor necessary to carry out the provisions of his/her contract. Insofar as possible, the contractor in carrying out the work, must employ such methods or means as will not cause any interruption of or interference with the work of any other contractor.

9. OBLIGATION OF BIDDER: At the time of the opening of bids each bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the plans and contract documents (including all addenda). The failure or omission of any bidder to examine any form, instrument or document shall in no way relieve any bidder from any obligation in respect of his/her bid.

10. EXAMINATION OF SITE: Each bidder shall, and is hereby directed to inspect the entire site of the proposed work and judge for himself/herself as to all the circumstances affecting the cost and progress of the work and shall assume all patent and latent risks in connection therewith.

11. SOIL CONDITIONS: NA

12. WORKING FACILITIES: The plans show, in the general manner, the existing structures and the land available for construction purposes. The bidders must satisfy themselves of the conditions and difficulties that may be encountered in the execution of the work at this site.

13. ADDENDA AND INTERPRETATIONS: No official interpretation of the meaning of the plans, specifications or other pre-bid documents will be made to any bidder orally.

    Every request for such interpretation should be in writing and will be submitted via the "Clarifications" feature within PennBid, and to be given consideration, must be received at least five (5) days prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications which, if issued, will be distributed to all prospective bidders, not later than three (3) days prior to the date fixed for the opening of bids. Failure of any bidder to receive any such addendum or interpretation shall not relieve such bidder from any obligation under his/her bid as submitted. All addenda so issued shall become part of the contract documents.

14. WATER SUPPLY: NA

15. SIGNATURE OF BIDDERS: The firm, corporate or individual name of the bidder must be signed in ink in the space provided for the signatures on the proposed blanks. In the case of a corporation, the title of the officer signing must be stated and such officer must be thereunto duly authorized and the seal of said corporation duly affixed. In the case of a partnership, the signature of at least one of the partners must follow the firm name, using the term "member of the firm". In the case of an individual, use the terms "doing business as", or "sole owner". The bidder shall further state in his proposal the name and address of each person or corporation interested therein.

16. NOTICE OF SPECIAL CONDITIONS: Attention of the bidder is particularly called to those parts of the General Contract Conditions and other contract documents and specifications which deal with the following:

    a. Insurance requirements
    b. Provisions, Pennsylvania Prevailing Wage Act

c. Requirement for a payment bond and performance bond for 100% of contract price
d. Requirement that all subcontractors be approved by the Owner
e. Time-for-completion and liquidated damages requirements
f. Safety standards
g. Contractor's responsibility to obtain permits
h. Affirmative Action and Equal Opportunity provisions
i. Nondiscrimination/Sexual Harassment Clause

17. ADDITIONAL OBLIGATIONS UPON CONTRACT AWARD: Upon award of the contract but prior to issuance of the notice to proceed, the contractor shall submit all of the following documents, completed as required:

(a) Acceptance of Notice of Award
(b) Contract
(c) Insurance certificate(s) and/or policy(ies)
(d) Performance & Payment bonds
(e) Subcontractor declaration form
(f) (If over $10,000:) Certification of Bidder Regarding Equal Employment Opportunity
(g) (If over $10,000:) Certification(s) by (all) Proposed Subcontractors Regarding Equal Employment Opportunity
(h) (Omitted)
(k) (If over $100,000:) Certification by Contractor and Subcontractors of Compliance with Clean Air and Water Acts
(l) (Omitted)
(m) (All) Subcontractor's Certification(s) Concerning Labor Standards and Prevailing Wage Requirements

GENERAL CONTRACT CONDITIONS

ARTICLE 1 - CONTRACT AND CONTRACT DOCUMENTS

A. All applicable State laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the contract throughout, and they will be deemed to be included in the contract the same as though herein written out in full.

B. The Plans, Specifications and Addenda, hereinafter enumerated in Paragraph 1 of the Supplemental General Conditions shall form part of this Contract and the provisions thereof shall be as binding upon the parties hereto as if they were herein fully set forth. The table of contents, titles, headings, running headlines and marginal notes contained herein and in said documents are solely to facilitate reference to various provisions of the Contract Documents and in no way affect, limit or cast light on the interpretation of the provisions to which they refer.

ARTICLE 2 - PERFORMANCE AND PAYMENT BONDS

Simultaneously with his/her delivery of the executed contract, the Contractor shall furnish a surety bond or bonds as security for faithful performance of this contract and for the payment of all persons performing labor on the project under this contract and furnishing materials in connection with this contract, as specified in the General Conditions included herein. The surety on such bond or bonds shall be a duly authorized surety company satisfactory to the Owner. The bond shall be for 100 percent of the contract price. A Payment Bond and Performance Bond are required. Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney. Under certain conditions, and within the limits of State and local laws and regulations, the Owner may waive the requirement that the Payment and Performance Bond be underwritten by a surety company and may authorize in lieu thereof, a personal bond backed by a letter of credit from a local lending institution for the full value of the Contract.

ARTICLE 3 - WAGE RATES

In the event that the rate of wages paid for any trade or occupant in the locality where such work is being performed are under current collective agreements or understandings between bona fide organizations of labor and employer, then the wages to be paid shall be not less than such agreed wage rates, nor less than the minimum rates compiled by the Commonwealth of Pennsylvania. A copy of these prevailing rates of wages has been included in these specifications.

Every Contractor and Subcontractor who is subject to this contract shall, as soon as he/she begins performance under his/her contract with the Owner, supply the Owner a schedule of the dates on which he/she is required to pay wages to employees. After construction begins he/she shall also deliver to the prevailing wage coordinator a weekly, a certified copy of his/her payroll which shall exhibit for each employee paid any wages, name, current address, identification number, number of hours worked each day of the pay period and the total for each week, hourly rate of pay, job classification, fringe payments, and deductions from wages. The certification of each payroll shall be executed by the Contractor, Subcontractor, or duly appointed agent thereof and shall recite that the payroll is correct and complete and that the wage rate shown is not less than those required by the contract.

ARTICLE 4 - OMITTED

ARTICLE 5 - INSURANCE

A. The contractor shall not commence work under this contract until he/she has obtained all the insurance required hereunder and such insurance has been approved by the Owner, nor shall the Contractor allow any Subcontractor to commence work on his/her subcontract until similar insurance required of the Subcontractor has been so obtained and approved. Approval of the insurance by the Owner shall not relieve or decrease the liability of the Contractor hereunder.

B. The Contractor shall file with the Owner all Certificate(s) of Insurance as are necessary to document the insurance coverage required hereunder, subject to the approval of the Owner and receipt of any additional forms/documentation requested, prior to final execution of Agreement Contract and issuance of the Notice to Proceed.

C. Worker's Compensation.

All contractors and subcontractors shall acquire and maintain, during the term of the contract, Worker's Compensation insurance in full compliance with the laws of the State of Pennsylvania. The contractor shall at all times indemnify and save harmless the Owner from all claims for worker's compensation which may be made by any of the employees of any subcontractor to whom the Contract may have let the performance of any part of the work embraced in this contract, and the Contractor will appear for and defend the Owner against any and all such claims.

D. Contractor's Liability Insurance.

(i) The Contractor shall acquire and maintain during the term of the Contract Bodily Injury and Property Damage Liability Insurance

under a standard Comprehensive General/Automobile Liability Policy which shall provide and include coverage on all Contractor's Operations, Contractor's Protective (Sublet) Liability, Contractual Liability, Completed Operations Liability, Owned Automobiles and Non-owned and Hired Automobiles.

(ii) Property Damage Liability Insurance shall be provided on any demolition, blasting, excavating, shoring or similar operation on an "if any" basis.

(iii) Bodily Injury Liability limits shall be for an amount of no less the Five Hundred Thousand ($500,000) Dollars for injuries, including wrongful death to any one person and subject to the same limit for each person, in amount of not less than One Million ($1,000,000) Dollars on the account of any one occurrence.

(iv) Property Damage Liability Insurance shall be in an amount of not less than Five Hundred Thousand ($500,000) Dollars per occurrence. General Liability shall be extended to provide "Broad Form Property Damage Liability," and in an amount of not less the One Million ($l,000,000) dollars aggregate for damage on account of all occurrences.

(v) Any combination of underlying Comprehensive General/Automobile Liability coverage with Umbrella/Excess Liability coverage which provides no less than One Million ($1,000,000) Dollars Single Limit Bodily Injury & Property Damage Liability Insurance for the Contractor will also be acceptable.

(vi) The owner may adjust the liability limits to coincide with local government procurement policies and practice within the limits of state and local law.

E. Builder's Risk Insurance.

Each Contractor shall maintain insurance to protect himself and the Owner, jointly, from loss incurred by fire, lightning, extended coverage hazards, vandalism, theft, explosion and malicious mischief in the full amount of the Contract and such insurance shall cover all labor and materials connected with the work, including materials delivered to the site but not yet installed.

F. Installation Floater Insurance.

When a Contractor is involved solely in the installation of materials and not in the construction of a building, an Installation Floater is required in lieu of a Builder's Risk Policy with the same general conditions applying as set forth in paragraph E.

G. The Policies as listed above shall all contain the following special provisions:

(i) "The Company agrees that thirty (30) days prior to cancellation or reduction of the insurance afforded by this policy with respect to the Contract involved, written notice will be mailed to the Chester Upland School District."

(ii) The maintaining of such insurance as outlined herein shall in no way constitute a waiver of legal liability for damage to any adjoining buildings or their contents or the work and property of others on the site beyond the limits of insurance thus maintained. The Contractor shall hold the Owner free and harmless from any injury and damage resulting from the negligent or faulty performance of the Contract by the Contractor or by his/or her Subcontractors.

H. Additional Insured: Chester Upland School District and MG Engineering Associates, LLC

ARTICLE 6 - PENNSYLVANIA STEEL PRODUCTS PROCUREMENT ACT (NO. 1978-3)

If any steel products are to be used or supplied in the performance of the contract, only steel products produced in the United States shall be used or supplied in the performance of the contract or any subcontracts thereunder. This provision shall not apply in any case where the head of the public agency, in writing, determines that the type of steel products necessary to the performance of the contract are not produced in the United States in sufficient quantities to meet the requirements of the contract.

(iii) Each Contractor shall hold the Owner harmless from all payments for patents, either as royalty or otherwise, in the use of materials, methods, appliances, etc., that he may be in any way involved in or connected with any part of his work or the work of his Subcontractors.

(iv) Prior to commencement of any work under Contract, the Contractor shall furnish one (1) copy of Declaration of Insurance as evidence of coverage.

ARTICLE 7 - SAFETY

A. The Contractor will be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. He/She will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury, or loss to all employees on the work and other persons who may be affected thereby, all the work and all materials or equipment to be incorporated therein, whether in storage on or off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

B. The Contractor will erect and maintain, as required by the conditions and progress of the Work, all necessary safeguards for safety protection. He/She will notify owners of adjacent utilities when prosecution of the work may affect them.

C. The Contractor shall comply with the safety standards provisions of applicable laws, building and construction codes and the manual of Accident Prevention in Construction published by the Associated General Contractors of America, the requirements of the Occupational Safety and Health Act of 1970 (Public Law 91-596), and the requirements of Title 29 of the Code of Federal Regulations,

Section 1518 as published in the "Federal Register" Volume 36, No. 75, Saturday, April 17, 1971.

D. The Contractor shall maintain at his/her office or other well known place at the job site, all articles necessary for giving first aid to the injured, and shall make standing arrangements for the immediate removal to a hospital or a doctor's care of persons (including employees) who may be injured at the job site. In no case shall employees be permitted to work at a job site before the employer has made a standing arrangement for removal of injured persons to a hospital or a doctor's care.

E. Lights, signs and barricades shall be used to maintain traffic and safety for vehicular and pedestrian traffic during the course of this contract in accordance with the specifications.

ARTICLE 8 - PERMITS

The Contractor is responsible for obtaining and paying for all necessary permits and Licenses from the proper authorities. The Contractor shall give all notices and comply with all laws, ordinances, rules, and regulations bearing on the conduct of the work as drawn and specified. If the Contractor observes that the Contract Documents are at variance therewith, he/she shall promptly notify the Owner in writing.

ARTICLE 9 - SUPERVISION

A. The Contractor will supervise and direct the work. He/She will be solely responsible for the means, methods, techniques, sequences, and procedures of construction. The Contractor will employ and maintain on the work a qualified supervisor or superintendent who shall have been designated in writing by the Contractor as the Contractor's representative at the site. The Supervisor shall have full authority to act on behalf of the Contractor and communications given to the supervisor shall be as binding as if given to the Contractor. The supervisor shall be present and on the site at all times as required to perform adequate supervision and coordination of the work.

B. The Owner and its representatives will at all times have access to the work. In addition, authorized representatives and agents of any participating federal or County agency shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records. The Contractor will provide proper facilities for such access and observation of the work and also for any inspection or testing thereof.

C. The Contractor shall submit a proposed program of operation, showing clearly how he/she proposed to conduct the work as to bring about the completion of his/her

work within the time limit specified. This program shall outline the proposed sequence of operations, the rates of progress and the dates when his/her work will be sufficiently advanced to permit the installation of the work under other contracts, and the estimated progress payments due under the Contract. The work under this contract shall be so scheduled that as structures are completed, they can be placed into useful operation with a minimum of delay. The program shall be subject to the approval of the Owner.

D. All construction as proposed along all City, Township, County, State and Federal roads including storage and stockpiling of materials, is to be conducted within the limits of the public right-of-way. Bracing, sheeting and shoring shall be used to keep all construction work within the construction limits unless work agreements are secured from the adjacent property Owners. It is the Contractor's responsibility to secure these work agreements, if deemed necessary. Copies of the work agreements shall be delivered to the Engineer and the Owner prior to any work beginning on the effected property.

ARTICLE 10 - CLAIMS AGAINST CONTRACTOR

The Contractor shall indemnify and save the Owner or the owner's agents harmless from all claims growing out of the lawful demands of Subcontractor's laborers, workmen, mechanics, material men, and furnishers of machinery and parts thereof, equipment, tools, and all supplies, incurred in the furtherance of the performance of the work. The Contractor shall, at the Owner's request, furnish satisfactory evidence that all obligations of the nature designated above have been paid, discharged or waived. If the Contractor fails to do so the Owner may, after having notified the Contractor, either pay unpaid bills or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is fully finished that all liabilities have been fully discharged whereupon payment to the Contractor shall be resumed, in accordance with the terms of the Contract Documents, but in no event shall the provisions of this sentence be construed to impose any obligations upon the Owner to either the Contractor, his Surety, or any third party. In paying any unpaid bills of the Contractor, any payment so made by the Owner shall be considered as a payment made under the Contract Documents by the owner to the Contractor and the Owner shall not be liable to the Contractor for any such payments in good faith.

ARTICLE 11 - SUBCONTRACTING

A. Neither the Contractor nor the owner shall sell, transfer, assign, or otherwise dispose of the Contract or any portion thereof, or of his right, title, or interest therein, or his obligations thereunder.

B. The Contractor shall not sublet, sell, transfer or assign any portion of the contract without consent of the Owner or his/her designated agent. No subcontract, or transfer of contract, shall in any way release the Contractor of his/her liability under the contract and bonds.

C. The Contractor shall not award work to Subcontractor(s) not identified on the Subcontractors Declaration Form as submitted with bid, without

i) Prior approval of the Owner

ii) Submission of all certifications as required in the INSTRUCTIONS TO BIDDERS. The Contractor shall be fully responsible to the Owner for the acts and omissions of the subcontractor(s), and of persons, either directly or indirectly employed by them, as he/she is for the acts and omissions of persons directly employed by him/her.

ARTICLE 12 - CHANGE OF WORK

A. The Owner reserves the right to make, at any time during the progress of the work, such increases or decreases in quantities and such alterations in details of work as may be deemed necessary or desirable. Such increases or decreases and alterations shall not invalidate the contract nor release the surety, and the Contractor agrees to perform the work as altered, the same as if it had been a part of the original contract.

B. Authorized alterations in plans or quantities of work involving work not covered by unit prices in the proposal shall be paid for as stipulated in the change order authorizing such work.

C. No changes in work covered by the approved Contract shall be made without having prior written approval of the Owner.

ARTICLE 13 - TIME

A. The Date of beginning and the time for completion of the work are essential conditions of the Contract Documents and the work embraced shall be commenced on a date specified in the Notice to Proceed.

B. The Contractor will proceed with the work at such rate of progress to ensure full completion within the Contract Time. It is expressly understood and agreed, by and between the Contractor and the Owner, that the Contract Time for the completion of the work described herein is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the work.

C. The Contract Time to fully complete the project shall be consecutive calendar days following the date of commencement of work to be specified in a written "Notice to Proceed".

D. If the Contractor shall fail to complete the work within the Contract Time, or extension of time granted by the Owner, the Contractor will pay to the Owner for liquidated damages $500.00 for each calendar day that the Contractor shall be in default after the time stipulated in the Contract Documents.

ARTICLE 14 - COMPLETION OF WORK

A. The Contractor shall guarantee all materials and equipment furnished and work performed for a period of one year from the date of Substantial Completion. The Contractor warrants and guarantees for a period of one year from the date of Substantial Completion of the improvement that it is free from all defects due to faulty materials or workmanship, and the Contractor shall promptly make corrections as may be necessary by reason of such defects. The owner will give notice of observed defects with reasonable promptness. In the event that the Contractor should fail to make repairs, adjustments, or other work, which may be made necessary by such defects, the Owner may do so and charge the Contractor the cost thereby incurred. Upon 100% completion of the improvements, the contractor shall provide a Maintenance Bond in the amount of 15% of the cost of the improvements for a period of 1-year.

B. When the work, including that performed by Subcontractors, is completed, the site shall be cleaned of all rubbish and debris caused by the construction. All sheds or other temporary structures, surplus materials, and equipment shall be removed and the project left in a neat and presentable condition.

ARTICLE 15 - TERMINATION

After ten (10) days from delivery of a Written Notice to the Contractor, the Owner may, without cause and without prejudice to any other right or remedy elects to terminate the Contract. In such case the Contractor shall be paid for all work executed and any expense sustained plus reasonable profit, unless such termination was due to the act or conduct of the Contractor.

ARTICLE 16 - PAYMENT

Payment to the Contractor shall be made by the Chester Upland School District upon receiving invoice from contractor and inspection of work completed. The Owner's representative and the project engineer shall certify on the pay request that the completed work has been approved prior to the submission of the invoice. Retainage to be held should

be reflected by the engineer/architect on the contractor's original invoice. A turn-around time of 3-4 weeks is expected before said funds are forwarded to the contractor.

It is important that the progress schedule be based on achievable goals, and that the Contractor makes every effort to meet target dates. The Chester Upland School District may hold the pay request, or a portion of the pay request, in cases where the Contractor is found to be in violation of any of the terms and conditions in this contract, e.g. federal labor standards compliance, until such violations are corrected.

ARTICLE 17 - LIVE UTILITIES AND OTHER PROPERTY

The contractor shall assume all responsibility for damage attributed to him to any property upon, or passing through, the Project Area, but excluded from the work or not owned by the Local Public Agency, such as utility lines, surface improvements, or like items.

If disconnections of underground utility services are required to be made in public thoroughfares, the Contractor shall comply with all local requirements and regulations respecting the barricade of streets, the removal and restoration of pavement, and other pertinent matters.

ARTICLE 18 - LIVE UTILITIES AND OTHER PROPERTY

The contractor shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms conditions and agreements of said contract.

If disconnections of underground utility services are required to be made in public thoroughfares, the Contractor shall comply with all local requirements and regulations respecting the barricade of streets, the removal and restoration of pavement, and other pertinent matters.

ARTICLE 19 - HOLD HARMLESS

The contractor shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the Local Public Agency, with or without notice to the Surety, and he shall satisfy all claims and demands incurred under such contract and shall fully indemnify and save harmless the Local Public Agency from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the Local Public Agency all outlay and expense which the Local Public Agency may incur in making good any default.

SUPPLEMENTAL GENERAL CONDITIONS

1. ENUMERATION OF PLANS, SPECIFICATIONS AND ADDENDA

Following are the Plans, Specifications, and Addenda which form a part of this contract, as set forth in Article I of the General Contract Conditions, "Contract and Contract Documents".

Drawings:	Date per Plans
Specifications:	Date per Plans
Technical Specifications	

Addenda:	Number	Date

2. STATED ALLOWANCES: Not Included

3. SPECIAL HAZARDS : Not Included

4. CONTRACTOR'S AND SUBCONTRACTOR'S PUBLIC LIABILITY, VEHICLE LIABILITY, AND PROPERTY DAMAGE INSURANCE

See Article 5 of General Contract conditions.

The Contractor shall either (1) require each of his/her subcontractors to procure and to maintain during the life of his/her subcontract, Subcontractor's Public Liability and Property Damage of the type and in the same amounts as specified in Article 5, or (2) insure the activities of his/her subcontractors in his/her own policy.

6. BUILDER'S RISK INSURANCE

The Contractor will maintain Builder's Risk Insurance (fire and extended coverage) on a 100 percent completed value basis on the insurable portions of the project for the benefit of the Owner, the Contractor, and all subcontractors, as their interests may appear.

CONTRACT

THIS AGREEMENT made this _____ day of _____, 20__, by and between _____hereinafter called the "Contractor, and _____hereinafter called the "Owner".

WITNESSETH, that the Contractor and the Owner for the considerations stated herein mutually agree as follows:

ARTICLE 1. Statement of Work.

The Contractor shall furnish all supervision, technical personnel, labor, materials, machinery, tools, equipment and services, including utility and transportation services, and perform and complete all work required for the construction of the Improvements embraced in the project; namely, _____, and required supplemental work for the _____all in strict accordance with the Contract Documents including all addenda thereto, numbered _____, dated _____, and _____dated , all as prepared by _____ acting and in these Contract documents preparation, referred to as the "Engineer".

ARTICLE 2. The Contract Price.

The Owner will pay the Contractor for the total quantities of work performed at the unit prices stipulated in the Bid for the respective items of work completed for the sum not to exceed _____ _____ (Dollars) subject to additions and deductions as provided in Section ___ hereof.

ARTICLE 3. Contract.

The executed contract documents shall consist of the following:

a. This Agreement
b. Addenda
c. Invitation for Bids
d. Instructions to Bidders
e. Signed copy of Bid
f. General Conditions, Parts I and II
g. Special Conditions
h. Technical Specifications
i. Drawings (as listed in the Schedule of Drawings)
j. Other Contract Provisions required by Chester Upland School District

This Agreement, together with other documents enumerated in this ARTICLE 3, which said other documents are as fully a part of the Contract as if hereto attached or herein repeated, forms the Contract between the parties hereto. In the event that any provision in any component part of this Contract conflicts with any provision of any other component part, the provision of the component part first enumerated in this ARTICLE 3 shall govern, except as otherwise specifically stated.
IN WITNESS WHEREOF, the parties hereto have caused this AGREEMENT to be executed in _ _____original copies on the day and year first above written.

CONTRACTOR:	OWNER:
_____	_____
Signature	Signature
_____	_____
Typed/printed name	Typed/printed name
_____	_____
Title	Title

<u>Certifications</u>:

I, _____, certify that I am the _____ of the corporation named as Contractor herein; that _____who signed this Agreement on behalf of the Contractor, was then _____ of said corporation; that said Agreement was duly signed for and in behalf of said corporation by authority of its governing body, and is within the scope of its corporate powers.

_____ (Corporate Seal)

PERFORMANCE AND PAYMENT BOND (OR BONDS)

Following the Form of Agreement, attach the approved form of the statutory surety bond or bonds to insure the performance of the Contract and payment of labor and materials. In addition to the corporation signatures of the surety company(ies) on the bond(s), each bond should be countersigned by the surety company's attorney-in-fact, authorized to act within the state in which the Project is situated.

MS-944S **PAYMENT BOND**

KNOW ALL MEN BY THESE PRESENTS, that we, _____ of _____ , as PRINCIPAL and _____ a corporation incorporated under the laws of the State of _____ as Surety, are held and firmly bond unto the _____ in the full and just sum of _____ ($_____) dollars, lawful money of the United States of America, to be paid to the said _ or its assigns, to which payment well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the above bounden Principal has entered into a contract with the above, hereinafter called Obligee, bearing even date herewith, for the improvement of:

_____

_____

for approximately the sum of _____ ($_____) dollars.

NOW, THEREFORE, the condition of this obligation is such that the above bounden PRINCIPAL shall and will promptly pay cause to be paid in full all sums of money which may be due by contractor or otherwise, to any individual, firm, partnership, association or corporation, for all material furnished or labor supplied or performed in the prosecution of the work, whether or not the said material or labor entered into and became component parts of the work and for rental of the equipment used and services rendered by public utilities in, or in connection with the prosecution of such work, then this obligation to be void, otherwise to remain in full force and effect.

THE PRINCIPAL and SURETY, hereby, jointly and severally, agree with the Obligee herein that any individual firm, partnership, association or corporation, which has performed labor or furnished material in the prosecution of the work as provided, and any public utility which has not been paid in full therefore, may sue in assumpsit on this Payment Bond, in his, their, or its own name and may prosecute the same to final judgment for such sum or sums as may be justly due him, them or it, and have execution thereon. Provided, however, that the Obligee shall not be liable for the payment of any costs of expenses of such suit.

RECOVERY by any individual, firm, partnership, association or corporation hereunder shall be subject to the provisions of the "Public Works Contractor's Bond Law of 167", Act No. 385, approved December 20, 1967, P.L. 869, which Act shall be incorporated herein and made a part hereof, as fully and completely as though its provisions were fully and at length herein recited.

It is further provided that any alteration which may be made in the terms of the contract or its work to be done or materials to be furnished or labor to be supplied or performed under it or the giving by the Obligee of any extension of time for the performance of the contract or any other forbearance on the part of either the Obligee or the Principal to the other, shall not in any way release the PRINCIPAL and the SURETY or SURETIES of any such alteration, extension or forbearance being hereby waived.

IN WITNESS WHEREOF, the said PRINCIPAL and SURETY have duly executed this Bond under seal the _____ day of _____, 20____.

WITNESS: _____
PLACE Contractor
SEAL
HERE

_____ BY _____
Title: Title:

WITNESS:
PLACE
SEAL
HERE

_____ Surety Company

_____ _____

Title: Title:

MS-944S (10-83)

PERFORMANCE BOND
(With Corporate Surety)

KNOW ALL MEN BY THESE PRESENTS, that we, _____(Name and Address of Contractor)

as Principal and _____
(Surety Company)

a corporation incorporated under the laws of the State of _____as Surety.
(Name of State)

are held and firmly bound unto _____ in
(Name of Contract Owner)

the full and just sum of _____ ($_____) dollars lawful money of the United States of America, to be paid to the above Owner or its assigns, to which payment well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the above bounden Principal has entered into a contract with the above District, bearing even date herewith, for the undertaking of certain obligations as therein set forth.

NOW, THEREFORE, the condition of this obligation is such that if the above bounden Principal, as Contractor, shall in all respects comply with and faithfully perform the terms and conditions of said Contract, including the Specifications and conditions referred to and made a part thereof, and such alterations as may be made in said specifications as therein set forth, then this Obligation shall be void, but otherwise the same shall be and remain in full force, virtue and effect.

It is further provided that any alteration which may be made in the terms of the contract or its specifications with the express approval of the District or the Principal to the other, shall not in any way release the Principal and the Surety or either of any of them, their heirs, executors, administrators, successors or assigns from their liability hereunder, notice to the Surety of any such alteration or forbearance being hereby waived.

IN WITNESS WHEREOF, the said Principal and Surety have duly executed this Bond under Seal, pursuant to due and legal action authorizing the same to be done on _____.
(Date of Bond)

Attest/Witness: _____

_____
PLACE
SEAL
HERE

Contractor

_____ BY _____
Title: Title:

Attest/Witness: _____

_____
PLACE
SEAL
HERE

Surety Company

_____ _____
Title: Title:

NOTICE OF AWARD

To: _____

_____

_____

PROJECT Description: _____

_____

_____

The OWNER has considered the BID submitted by you on _____, 20__ (BID Date) for the above described WORK in response to its Advertisement for BIDS and Information for BIDDERS.

You are hereby notified that your BID has been accepted for items in the amount of $____
.

You are required by the Information for BIDDERS to execute the Agreement and furnish the required CONTRACTOR's Contract BOND, if applicable, and Certificates of Insurance within 10 calendar days from the date of this notice to you.

If you fail to execute said Agreement and to furnish said BOND within 10 days from the date of this notice, said OWNER will be entitled to consider all your rights arising out of the OWNER's acceptance of your BID as abandoned and as a forfeiture of your BID guaranty. The OWNER will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this NOTICE OF AWARD to the OWNER.

Dated this ____ day of _____, 20__.

_____
Owner

By: _____

Name: _____

Title: _____

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged by: _____
_____ on this _____day of _____, 20__.

By: _____

Name and Title: _____

cc: CONTRACTOR's Surety
Surety's Agent

NOTICE TO PROCEED

To: _____ Date: _____

_____

_____

PROJECT Description: _____
_____

_____

You are hereby notified to commence WORK in accordance with the Agreement dated , 20__, on or

after _____, 20__, and you are to complete the WORK within _____ consecutive calendar days thereafter.

The date of completion of all WORK is therefore _____, 20__.

_____
Owner

By: _____

Name: _____

Title: _____

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO
PROCEED is hereby acknowledged
by _____
on this _____ day of _____, 20___.

By: _____

Name: _____

Title: _____

CONTRACT CHANGE ORDER

Contract No._____ Date _____
Change Order No._____ Project No._____

To: (Contractor) _____

You are hereby requested to comply with the following changes from the contract plans and specifications:

ITEM NO. (1)	DESCRIPTION OF CHANGES – QUANTITIES, UNIT, UNIT PR CHANGE IN COMPLETION SCHEDULE, ETC. (2)	DECREASE IN CONTRACT PRICE (3)	INCREASE IN CONTRACT PRICE (4)
	Change in contract price due to this change order	$	$
	Total decrease	$	$
	Total increase	$	$
	Difference between Columns (3) and (4)	$	$
	Net (increase) (decrease) contract price	$	$

The sum of $_____ is hereby added to, deducted from, the total contract price and the total adjusted price to date thereby is $_____.

The time provided for completion in the contract is unchanged, increased, decreased, by ___ calendar days. This document shall become an amendment to the contract and all provisions of the contract will apply hereto.

Accepted by: _____ _____
Contractor Date

Recommended by: _____ _____
Architect/Engineer Date

Approved by: _____ _____
Chester Upland School District Date

Note: Work performed under this change order prior to District concurrence is at owner's risk. District concurrence will be evidenced by signature of Engineer and Owner

004116 - BID FORM - STIPULATED SUM – GENERAL CONTRACT

1.1 BID INFORMATION

A. Bidder: _____.

B. Project Name: **CUSD Main Street School Cafeteria HVAC Improvements**

C. Project Location:
1. Main Street Elementary School – 704 Main Street, Chester, PA 19015

D. Owner: Chester Upland School District

1.2 CERTIFICATIONS AND GENERAL BASE BID

A. Base Bid, Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by MG Engineering Associates, LLC, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

1. _____Dollars ($_____).

B. Bid Allowance: The Bid Allowance has been added to the bid to cover any unforeseen conditions and permit fees associated with the project.

1. _Ten-Thousand Dollars ($_10,000.00___).

1.3 BID GUARANTEE

A. The undersigned Bidder agrees to execute a contract for this Work in the above amount and to furnish surety as specified within **10** days after a written Notice of Award, if offered within **60** days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached cash, cashier's check, certified check, U.S. money order, or bid bond, as liquidated damages for such failure, in the following amount constituting five percent (5%) of the Base Bid amount above:

1. _____ Dollars ($_____).

B. In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the cash, cashier's check, certified check, U.S. money order, or bid bond.

1.4 TIME OF COMPLETION

A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Engineer, and shall fully complete the Work within 120 calendar days.

1.5 ACKNOWLEDGEMENT OF ADDENDA

A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

1. Addendum No. 1, dated _____.
2. Addendum No. 2, dated _____.
3. Addendum No. 3, dated _____.
4. Addendum No. 4, dated _____.

1.6 BID SUPPLEMENTS

A. The following supplements are a part of this Bid Form and are attached hereto.

B.

1. Bid Form Supplement - Bid Bond Form (AIA Document A310-2010).

1.7 CONTRACTOR'S LICENSE

A. The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in the Commonwealth of Pennsylvania, and that all fees, permits, etc., pursuant to submitting this proposal have been paid in full.

1.8 SUBMISSION OF BID

A. Respectfully submitted this ____ day of _____, 2024

B. Submitted By:_____(Name of bidding firm or corporation).

C. Authorized Signature:_____(Handwritten signature).

D. Signed By:_____(Type or print name).

E. Title:_____(Owner/Partner/President/Vice President).

F. Witness By:_____(Handwritten signature).

G. Attest:_____(Handwritten signature).

H. By:_____(Type or print name).

I. Title:_____(Corporate Secretary or Assistant Secretary).

J. Street Address:_____.

K. City, State, Zip:_____.

L. Phone:_____.

M. License No.:_____.

N. Federal ID No.:_____(Affix Corporate Seal Here).

END OF DOCUMENT 004116

004116 - BID FORM - STIPULATED SUM – ELECTRICAL CONTRACT

1.1 BID INFORMATION

A. Bidder: _____.

B. Project Name: **CUSD Main Street School Cafeteria HVAC Improvements**

C. Project Location:
1. Main Street Elementary School – 704 Main Street, Chester, PA 19015

D. Owner: Chester Upland School District

1.2 CERTIFICATIONS AND ELECTRICAL BASE BID

A. Base Bid, Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by MG Engineering Associates, LLC, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

1. _____Dollars ($_____).

B. Bid Allowance: The Bid Allowance has been added to the bid to cover any unforeseen conditions and permit fees associated with the project.

1. _Ten-Thousand Dollars ($_10,000.00___).

1.3 BID GUARANTEE

A. The undersigned Bidder agrees to execute a contract for this Work in the above amount and to furnish surety as specified within **10** days after a written Notice of Award, if offered within **60** days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached cash, cashier's check, certified check, U.S. money order, or bid bond, as liquidated damages for such failure, in the following amount constituting five percent (5%) of the Base Bid amount above:

1. _____ Dollars ($_____).

B. In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the cash, cashier's check, certified check, U.S. money order, or bid bond.

1.4 TIME OF COMPLETION

A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Engineer, and shall fully complete the Work within 120 calendar days.

1.5 ACKNOWLEDGEMENT OF ADDENDA

A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

1. Addendum No. 1, dated _____.
2. Addendum No. 2, dated _____.
3. Addendum No. 3, dated _____.
4. Addendum No. 4, dated _____.

1.6 BID SUPPLEMENTS

A. The following supplements are a part of this Bid Form and are attached hereto.

B.

1. Bid Form Supplement - Bid Bond Form (AIA Document A310-2010).

1.7 CONTRACTOR'S LICENSE

A. The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in the Commonwealth of Pennsylvania, and that all fees, permits, etc., pursuant to submitting this proposal have been paid in full.

1.8 SUBMISSION OF BID

A. Respectfully submitted this ____ day of _____, 2024

B. Submitted By:_____(Name of bidding firm or corporation).

C. Authorized Signature:_____(Handwritten signature).

D. Signed By:_____(Type or print name).

E. Title:_____(Owner/Partner/President/Vice President).

F. Witness By:_____(Handwritten signature).

G. Attest:_____(Handwritten signature).

H. By:_____(Type or print name).

I. Title:_____(Corporate Secretary or Assistant Secretary).

J. Street Address:_____.

K. City, State, Zip:_____.

L. Phone:_____.

M. License No.:_____.

N. Federal ID No.:_____(Affix Corporate Seal Here).

END OF DOCUMENT 004116

004116 - BID FORM - STIPULATED SUM – MECHANICAL CONTRACT

1.1 BID INFORMATION

A. Bidder: _____.

B. Project Name: **CUSD Main Street School Cafeteria HVAC Improvements**

C. Project Location:
1. Main Street Elementary School – 704 Main Street, Chester, PA 19015

D. Owner: Chester Upland School District

1.2 CERTIFICATIONS AND MECHANICAL BASE BID

A. Base Bid, Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by MG Engineering Associates, LLC, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

1. _____Dollars ($_____).

B. Bid Allowance: The Bid Allowance has been added to the bid to cover any unforeseen conditions and permit fees associated with the project.

1. _Ten-Thousand Dollars ($_10,000.00___).

1.3 BID GUARANTEE

A. The undersigned Bidder agrees to execute a contract for this Work in the above amount and to furnish surety as specified within **10** days after a written Notice of Award, if offered within **60** days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached cash, cashier's check, certified check, U.S. money order, or bid bond, as liquidated damages for such failure, in the following amount constituting five percent (5%) of the Base Bid amount above:

1. _____ Dollars ($_____).

B. In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the cash, cashier's check, certified check, U.S. money order, or bid bond.

1.4 TIME OF COMPLETION

A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Engineer, and shall fully complete the Work within 120 calendar days.

1.5 ACKNOWLEDGEMENT OF ADDENDA

A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

1. Addendum No. 1, dated _____.
2. Addendum No. 2, dated _____.
3. Addendum No. 3, dated _____.
4. Addendum No. 4, dated _____.

1.6 BID SUPPLEMENTS

A. The following supplements are a part of this Bid Form and are attached hereto.

B.

1. Bid Form Supplement - Bid Bond Form (AIA Document A310-2010).

1.7 CONTRACTOR'S LICENSE

A. The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in the Commonwealth of Pennsylvania, and that all fees, permits, etc., pursuant to submitting this proposal have been paid in full.

1.8 SUBMISSION OF BID

A. Respectfully submitted this ____ day of _____, 2024

B. Submitted By:_____(Name of bidding firm or corporation).

C. Authorized Signature:_____(Handwritten signature).

D. Signed By:_____(Type or print name).

E. Title:_____(Owner/Partner/President/Vice President).

F. Witness By:_____(Handwritten signature).

G. Attest:_____(Handwritten signature).

H. By:_____(Type or print name).

I. Title:_____(Corporate Secretary or Assistant Secretary).

J. Street Address:_____.

K. City, State, Zip:_____.

L. Phone:_____.

M. License No.:_____.

N. Federal ID No.:_____(Affix Corporate Seal Here).

END OF DOCUMENT 004116

SECTION 006000 - PROJECT FORMS

1.1 FORM OF AGREEMENT AND GENERAL CONDITIONS

A. The following form of Owner/Contractor Agreement and form of the General Conditions shall be used for Project:

1. The General Conditions are included in the Project Manual
2. The Supplementary Conditions for Project are separately prepared and included in the Project Manual.

1.2 ADMINISTRATIVE FORMS

A. Administrative Forms: Additional administrative forms are specified in Division 01 General Requirements.

B. Copies of AIA standard forms may be obtained from the American Institute of Architects; www.aiacontractdocsaiacontracts.org; (800) 942-7732.

C. Preconstruction Forms:

1. Form of Performance Bond and Labor and Material Bond: included in Project Manual
2. Form of Certificate of Insurance: AIA Document G715-2017 "Supplemental Attachment for ACORD Certificate of Insurance 25."

D. Information and Modification Forms:

1. Form for Requests for Information (RFIs): AIA Document G716-2004 "Request for Information (RFI)."
2. Form of Request for Proposal: AIA Document G709-2018 "Proposal Request."
3. Change Order Form: AIA Document G701-2017 "Change Order."
4. Form of Architect's Memorandum for Minor Changes in the Work: AIA Document G710-2017 "Architect's Supplemental Instructions."
5. Form of Change Directive: AIA Document G714-2017 "Construction Change Directive."

E. Payment Forms:

1. Schedule of Values Form: AIA Document G703-1992 "Continuation Sheet."
2. Payment Application: AIA Document G702-1992/703-1992 "Application and Certificate for Payment and Continuation Sheet."
3. Form of Contractor's Affidavit: AIA Document G706-1994 "Contractor's Affidavit of Payment of Debts and Claims."
4. Form of Affidavit of Release of Liens: AIA Document G706A-1994 "Contractor's Affidavit of Payment of Release of Liens."
5. Form of Consent of Surety: AIA Document G707-1994 "Consent of Surety to Final Payment."

END OF SECTION 006000

SUBCONTRACTOR DECLARATION FORM

Each prime contractor is required to submit a list of subcontractors it intends to use on the project.

Subcontractor	Business Address	Type of Work

_____

Project Name

_____

Prime Contractor

_____

Signature Title Date

NONDISCRIMINATION CLAUSE

During the term of this contract, Contractor agrees as follows:

1. In the hiring of any employee(s) for the manufacture of supplies, performance of work, or any other activity required under the grant agreement or any subgrant agreement, contract, or subcontract, the Grantee, a subgrantee, a contractor, a subcontractor, or any person acting on behalf of the Grantee shall not discriminate by reason of race, gender, creed, color, sexual orientation, gender identity or expression, or in violation of the *Pennsylvania Human Relations Act* (PHRA) and applicable federal laws, against any citizen of this Commonwealth who is qualified and available to perform the work to which the employment relates.

2. The Grantee, any subgrantee, contractor or any subcontractor or any person on their behalf shall not in any manner discriminate by reason of race, gender, creed, color, sexual orientation, gender identity or expression, or in violation of the PHRA and applicable federal laws, against or intimidate any of its employees.

3. Neither the Grantee nor any subgrantee nor any contractor nor any subcontractor nor any person on their behalf shall in any manner discriminate by reason of race, gender, creed, color, sexual orientation, gender identity or expression, or in violation of the PHRA and applicable federal laws, in the provision of services under the grant agreement, subgrant agreement, contract or subcontract.

4. Neither the Grantee nor any subgrantee nor any contractor nor any subcontractor nor any person on their behalf shall in any manner discriminate against employees by reason of participation in or decision to refrain from participating in labor activities protected under the *Public Employee Relations Act, Pennsylvania Labor Relations Act or National Labor Relations Act,* as applicable and to the extent determined by entities charged with such Acts' enforcement, and shall comply with any provision of law establishing organizations as employees' exclusive representatives.

5. The Grantee, any subgrantee, contractor or any subcontractor shall establish and maintain a written nondiscrimination and sexual harassment policy and shall inform their employees in writing of the policy. The policy must contain a provision that sexual harassment will not be tolerated and employees who practice it will be disciplined. Posting this Nondiscrimination/Sexual Harassment Clause conspicuously in easily-accessible and well-lighted places customarily frequented by employees and at or near where the grant services are performed, shall satisfy this requirement for employees with an established work site.

6. The Grantee, any subgrantee, contractor or any subcontractor shall not discriminate by reason of race, gender, creed, color, sexual orientation, gender identity or expression, or in violation of the PHRA and applicable federal laws, against any subgrantee, contractor, subcontractor or supplier who is qualified to perform the work to which the grant relates.

7. The Grantee, and each subgrantee, contractor and subcontractor represents that it is presently in compliance with and will maintain compliance with all applicable federal, state, and local laws and regulations relating to nondiscrimination and sexual harassment. The Grantee and each subgrantee, contractor and subcontractor further represents that it has filed a Standard Form 100 Employer Information Report ("EEO-1") with the U.S. Equal Employment Opportunity Commission ("EEOC") and shall file an annual EEO-1 report with the EEOC as required for employers' subject to *Title VII* of the *Civil Rights Act of 1964*, as amended, that have 100 or more employees and employers that have federal government contracts or first-tier subcontracts and have 50 or more employees. The Grantee, any subgrantee, any contractor or any subcontractor shall, upon request and within the time periods requested by the Commonwealth, furnish all necessary employment documents and records, including EEO-1 reports, and permit access to their books, records, and accounts by the granting agency and the Bureau of Diversity, Inclusion and Small Business Opportunities for the purpose of ascertaining compliance with the provisions of this Nondiscrimination/Sexual Harassment Clause.

8. The Grantee, any subgrantee, contractor or any subcontractor shall include the provisions of this Nondiscrimination/Sexual Harassment Clause in every subgrant agreement, contract or subcontract so that those provisions applicable to subgrantees, contractors or subcontractors will be binding upon each subgrantee, contractor or subcontractor.

9. The Granter's and each subgrantee's, contractor's and subcontractor's obligations pursuant to these provisions are ongoing from and after the effective date of the grant agreement through the termination date thereof. Accordingly, the Grantee and each subgrantee, contractor and subcontractor shall have an obligation to inform the Commonwealth if, at any time during the term of the grant agreement, it becomes aware of any actions or occurrences that would result in violation of these provisions.

10. The Commonwealth may cancel or terminate the grant agreement and all money due or to become due under the grant agreement may be forfeited for a violation of the terms and conditions of this Nondiscrimination/Sexual Harassment Clause. In addition, the granting agency may proceed with debarment or suspension and may place the Grantee, subgrantee, contractor, or subcontractor in the Contractor Responsibility File.

CONTRACTOR_____ Date _____

CONFLICT OF INTEREST

Interest of Local Public Officials

No member of the governing body of the locality or entity and no other officer, employee, agent or public official of such locality, who exercises any functions or responsibilities in connection with the planning and carrying out of the program, shall have any personal financial interest, direct or indirect, in this contract; and the governing body contractor shall take appropriate steps to assure compliance.

Interest of Contractor and Employees

The Contractor covenants that he presently has no interest and shall not acquire interest, direct or indirect, in the study area or any parcels therein or any other interest which would conflict in any manner or degree with the performance of his services hereunder. The Contractor further covenants that in the performance of this Contract, no person having any such interest shall be employed.

RECORDS AND AUDITS

The Contractor shall maintain accounts and records, including personnel, property and financial records, adequate to identify and account for all costs pertaining to the Contract and such other records as may be deemed necessary by the Municipality and County to assure proper accounting for all project funds. These records will be made available for audit purposes to the Municipality and County or any authorized representative, and will be retained for three years after the close out of the project by the County unless stipulated otherwise by the County.

The undersigned contractor agrees to abide by the above provisions.

By: _____ _____

Contractor Date

AFFIDAVIT RE

ACCEPTING PROVISIONS OF THE WORKMEN'S COMPENSATION ACT

State of)
)
) ss:
)
County of)

being duly sworn according to law deposes and says that he/she/it has (they have) accepted the provisions of the Workmen's Compensation Act of 1916 of the Commonwealth of Pennsylvania, with its supplements and amendments, and has (have) insured his/her (their) liability thereunder in accordance with the terms of said Act with

_____
(Surety Company)

_____
(Type or Print) Contractor

BY_____
Signature

Sworn to and subscribed before me this _____ day of _____ A.D. 20__

_____

My Commission Expires_____

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project Name:	Main Street School HVAC Improvements
General Description:	Work includes installation of a new HVAC System for the Main Street Cafeteria.
Project Locality	Borough of Upland
Awarding Agency:	Chester Upland School District
Contract Award Date:	2/1/2025
Serial Number:	24-10905
Project Classification:	Building
Determination Date:	12/23/2024
Assigned Field Office:	Philadelphia
Field Office Phone Number:	(215)560-1858
Toll Free Phone Number:	
Project County:	Delaware County

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 24-10905 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Asbestos & Insulation Workers	6/1/2023		$57.84	$43.36	$101.20
Asbestos & Insulation Workers	5/1/2024		$59.37	$46.03	$105.40
Boilermaker (Commercial, Institutional, and Minor Repair Work)	3/1/2024		$36.71	$19.13	$55.84
Boilermakers	1/1/2023		$51.27	$35.30	$86.57
Boilermakers	1/1/2024		$52.10	$35.72	$87.82
Bricklayer	5/1/2023		$47.50	$31.42	$78.92
Carpenter - Chief of Party (Surveying & Layout)	5/1/2023		$50.57	$29.02	$79.59
Carpenter - Chief of Party (Surveying & Layout)	5/1/2024		$52.58	$29.02	$81.60
Carpenter - Chief of Party (Surveying & Layout)	5/1/2025		$54.59	$29.02	$83.61
Carpenter - Instrument Person (Surveying & Layout)	5/1/2023		$43.97	$29.02	$72.99
Carpenter - Instrument Person (Surveying & Layout)	5/1/2024		$45.72	$29.02	$74.74
Carpenter - Instrument Person (Surveying & Layout)	5/1/2025		$47.47	$29.02	$76.49
Carpenter - Rodman (Surveying & Layout)	5/1/2023		$21.99	$20.62	$42.61
Carpenter - Rodman (Surveying & Layout)	5/1/2024		$22.86	$20.62	$43.48
Carpenter - Rodman (Surveying & Layout)	5/1/2025		$23.74	$20.62	$44.36
Carpenters	5/1/2023		$43.97	$29.02	$72.99
Carpenters	5/1/2024		$45.72	$29.02	$74.74
Carpenters	5/1/2025		$47.47	$29.02	$76.49
Cement Finishers & Plasterers	5/1/2022		$38.57	$32.39	$70.96
Cement Masons	5/1/2023		$44.20	$32.96	$77.16
Cement Masons	5/1/2024		$46.70	$32.46	$79.16
Dockbuilder, Pile Drivers	5/1/2023		$50.48	$37.99	$88.47
Dockbuilder, Pile Drivers	5/1/2024		$52.98	$37.99	$90.97
Dockbuilder, Pile Drivers	5/1/2025		$55.23	$37.99	$93.22
Dockbuilder, Pile Drivers	5/1/2026		$56.98	$37.99	$94.97
Dockbuilder/Pile Driver Diver	5/1/2023		$58.41	$41.74	$100.15
Dockbuilder/Pile Driver Diver	5/1/2024		$61.54	$41.74	$103.28
Dockbuilder/Pile Driver Diver	5/1/2025		$64.35	$41.74	$106.09
Dockbuilder/Pile Driver Diver	5/1/2026		$66.54	$41.74	$108.28
Dockbuilder/pile driver tender	5/1/2023		$50.48	$37.99	$88.47
Dockbuilder/pile driver tender	5/1/2024		$52.98	$37.99	$90.97
Dockbuilder/pile driver tender	5/1/2025		$55.23	$37.99	$93.22
Dockbuilder/pile driver tender	5/1/2026		$56.98	$37.99	$94.97
Drywall Finisher	5/1/2023		$38.77	$31.12	$69.89
Drywall Finisher	5/1/2024		$42.25	$32.56	$74.81
Electricians	5/30/2022		$47.64	$35.14	$82.78
Electricians	5/29/2023		$49.24	$36.04	$85.28
Electricians	6/3/2024		$50.17	$38.87	$89.04
Electricians	6/2/2025		$52.71	$40.07	$92.78
Electricians	6/1/2026		$55.25	$41.28	$96.53
Elevator Constructor	1/1/2023		$66.21	$43.64	$109.85
Elevator Constructor	1/1/2024		$68.97	$44.70	$113.67
Elevator Mechanic	1/1/2025		$71.85	$45.77	$117.62
Floor Coverer	5/1/2023		$50.12	$29.21	$79.33

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 24-10905 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Floor Coverer	5/1/2024		$52.19	$29.21	$81.40
Glazier	5/1/2023		$46.68	$36.62	$83.30
Glazier	5/1/2024		$48.00	$37.50	$85.50
Interior Finish	5/1/2023		$34.60	$25.80	$60.40
Iron Workers (Bridge, Structural, Ornamental, Precast)	1/1/2023		$50.70	$39.51	$90.21
Iron Workers (Bridge, Structural, Ornamental, Precast)	7/1/2024		$53.20	$45.01	$98.21
Iron Workers (Riggers)	7/1/2023		$42.53	$34.14	$76.67
Iron Workers (Riggers)	7/1/2024		$44.64	$34.39	$79.03
Iron Workers (Rodman/Reinforcing)	7/1/2023		$45.70	$34.77	$80.47
Iron Workers (Rodman/Reinforcing)	7/1/2024		$47.70	$34.77	$82.47
Laborers (Class 01 - See notes)	5/1/2022		$33.35	$25.65	$59.00
Laborers (Class 01 - See notes)	5/1/2023		$34.60	$25.80	$60.40
Laborers (Class 01 - See notes)	5/1/2024		$35.85	$26.00	$61.85
Laborers (Class 02 - See notes)	5/1/2022		$36.70	$27.00	$63.70
Laborers (Class 02 - See notes)	5/1/2023		$37.95	$27.30	$65.25
Laborers (Class 02 - See notes)	5/1/2024		$39.40	$27.55	$66.95
Laborers (Class 03 - See notes)	5/1/2022		$33.77	$25.83	$59.60
Laborers (Class 03 - See notes)	5/1/2023		$35.02	$25.98	$61.00
Laborers (Class 03 - See notes)	5/1/2024		$36.27	$26.18	$62.45
Laborers (Class 04 - See notes)	5/1/2022		$33.77	$25.83	$59.60
Laborers (Class 04 - See notes)	5/1/2023		$35.02	$25.98	$61.00
Laborers (Class 04 - See notes)	5/1/2024		$36.27	$26.18	$62.45
Laborers (Class 05 - See notes)	5/1/2022		$33.35	$25.65	$59.00
Laborers (Class 05 - See notes)	5/1/2023		$34.60	$25.50	$60.10
Laborers (Class 05 - See notes)	5/1/2024		$35.85	$26.00	$61.85
Landscape Laborer	5/1/2023		$29.45	$23.98	$53.43
Landscape Laborer	5/1/2024		$30.70	$24.23	$54.93
Marble Finisher	5/1/2022		$38.27	$29.15	$67.42
Marble Finisher	5/1/2023		$39.52	$29.30	$68.82
Marble Mason	5/1/2023		$47.20	$31.95	$79.15
Mason Tender, Cement	5/1/2023		$35.02	$25.98	$61.00
Millwright	5/1/2023		$51.60	$35.81	$87.41
Millwright	5/1/2024		$54.67	$35.81	$90.48
Millwright	5/1/2025		$57.39	$35.81	$93.20
Millwright	5/1/2026		$60.20	$35.81	$96.01
Operators (Building, Class 01 - See Notes)	5/1/2023		$52.20	$32.81	$85.01
Operators (Building, Class 01 - See Notes)	5/1/2024		$53.36	$33.65	$87.01
Operators (Building, Class 01 - See Notes)	5/1/2025		$54.52	$34.49	$89.01
Operators (Building, Class 01 - See Notes)	5/1/2026		$55.67	$35.34	$91.01
Operators (Building, Class 01A - See Notes)	5/1/2023		$55.20	$33.70	$88.90
Operators (Building, Class 01A - See Notes)	5/1/2024		$56.37	$34.53	$90.90
Operators (Building, Class 01A - See Notes)	5/1/2025		$57.52	$35.38	$92.90
Operators (Building, Class 01A - See Notes)	5/1/2026		$58.68	$36.22	$94.90
Operators (Building, Class 02 - See Notes)	5/1/2023		$51.95	$32.74	$84.69

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 24-10905 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Operators (Building, Class 02 - See Notes)	5/1/2024		$53.11	$33.58	$86.69
Operators (Building, Class 02 - See Notes)	5/1/2025		$54.27	$34.42	$88.69
Operators (Building, Class 02 - See Notes)	5/1/2026		$55.43	$35.26	$90.69
Operators (Building, Class 02A - See Notes)	5/1/2023		$54.97	$33.61	$88.58
Operators (Building, Class 02A - See Notes)	5/1/2024		$56.13	$34.45	$90.58
Operators (Building, Class 02A - See Notes)	5/1/2025		$57.29	$35.29	$92.58
Operators (Building, Class 02A - See Notes)	5/1/2026		$58.44	$36.14	$94.58
Operators (Building, Class 03 - See Notes)	5/1/2023		$47.87	$31.53	$79.40
Operators (Building, Class 03 - See Notes)	5/1/2024		$49.03	$32.37	$81.40
Operators (Building, Class 03 - See Notes)	5/1/2025		$50.18	$33.22	$83.40
Operators (Building, Class 03 - See Notes)	5/1/2026		$51.34	$34.06	$85.40
Operators (Building, Class 04 - See Notes)	5/1/2023		$47.57	$31.44	$79.01
Operators (Building, Class 04 - See Notes)	5/1/2024		$48.73	$32.28	$81.01
Operators (Building, Class 04 - See Notes)	5/1/2025		$49.88	$33.13	$83.01
Operators (Building, Class 04 - See Notes)	5/1/2026		$51.04	$33.97	$85.01
Operators (Building, Class 05 - See Notes)	5/1/2023		$45.85	$30.93	$76.78
Operators (Building, Class 05 - See Notes)	5/1/2024		$47.00	$31.78	$78.78
Operators (Building, Class 05 - See Notes)	5/1/2025		$48.16	$32.62	$80.78
Operators (Building, Class 05 - See Notes)	5/1/2026		$49.32	$33.46	$82.78
Operators (Building, Class 06 - See Notes)	5/1/2023		$44.85	$30.65	$75.50
Operators (Building, Class 06 - See Notes)	5/1/2024		$46.02	$31.48	$77.50
Operators (Building, Class 06 - See Notes)	5/1/2025		$47.17	$32.33	$79.50
Operators (Building, Class 06 - See Notes)	5/1/2026		$48.34	$33.16	$81.50
Operators (Building, Class 07A- See Notes)	5/1/2023		$63.33	$37.68	$101.01
Operators (Building, Class 07A- See Notes)	5/1/2024		$64.80	$38.61	$103.41
Operators (Building, Class 07A- See Notes)	5/1/2025		$66.26	$39.55	$105.81
Operators (Building, Class 07A- See Notes)	5/1/2026		$67.73	$40.48	$108.21
Operators (Building, Class 07B- See Notes)	5/1/2023		$63.04	$37.59	$100.63
Operators (Building, Class 07B- See Notes)	5/1/2024		$64.50	$38.53	$103.03
Operators (Building, Class 07B- See Notes)	5/1/2025		$65.97	$39.46	$105.43
Operators (Building, Class 07B- See Notes)	5/1/2026		$67.44	$40.39	$107.83
Painters Class 1 (see notes)	5/1/2023		$42.32	$32.91	$75.23
Painters Class 1 (see notes)	5/1/2024		$42.97	$34.11	$77.08
Painters Class 4 (see notes)	5/1/2023		$44.41	$32.91	$77.32
Painters Class 4 (see notes)	5/1/2024		$45.06	$34.11	$79.17
Plasterers	5/1/2023		$39.32	$32.64	$71.96
Plasterers	5/1/2024		$39.88	$33.08	$72.96
plumber	5/1/2023		$64.73	$37.61	$102.34
plumber	5/1/2024		$67.53	$38.31	$105.84
Pointers, Caulkers, Cleaners	5/1/2023		$48.80	$30.70	$79.50
Roofers (Composition)	5/1/2022		$41.48	$33.87	$75.35
Roofers (Composition)	5/1/2024		$44.13	$34.77	$78.90
Roofers (Shingle)	5/1/2023		$32.85	$22.10	$54.95
Roofers (Shingle)	5/1/2024		$34.35	$22.20	$56.55

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 24-10905 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Roofers (Slate & Tile)	5/1/2023		$35.85	$22.10	$57.95
Roofers (Slate & Tile)	5/1/2024		$37.35	$22.20	$59.55
Sheet Metal Workers	5/1/2023		$57.31	$48.97	$106.28
Sheet Metal Workers	5/1/2024		$59.22	$50.56	$109.78
Sign Makers and Hangars	7/15/2022		$30.54	$24.35	$54.89
Sign Makers and Hangars	7/15/2023		$31.76	$24.63	$56.39
Sign Makers and Hangars	7/15/2024		$32.32	$25.82	$58.14
Sprinklerfitters	1/1/2023		$62.23	$31.99	$94.22
Steamfitters	5/1/2023		$67.37	$41.99	$109.36
Steamfitters	5/1/2024		$70.32	$43.09	$113.41
Stone Masons	5/1/2022		$45.90	$31.20	$77.10
Stone Masons	5/1/2023		$47.20	$31.95	$79.15
Terrazzo Finisher	5/1/2022		$42.44	$27.71	$70.15
Terrazzo Finisher	5/1/2023		$43.75	$27.86	$71.61
Terrazzo Grinder	5/1/2022		$42.71	$27.71	$70.42
Terrazzo Grinder	5/1/2023		$44.02	$27.86	$71.88
Terrazzo Mechanics	5/1/2022		$48.81	$29.46	$78.27
Terrazzo Mechanics	5/1/2023		$50.26	$29.56	$79.82
Tile Finisher	5/1/2022		$38.27	$29.15	$67.42
Tile Finisher	5/1/2023		$39.52	$29.30	$68.82
Tile Setter	5/1/2022		$48.81	$29.46	$78.27
Tile Setter	5/1/2023		$50.26	$29.56	$79.82
Truckdriver class 1(see notes)	5/1/2023		$36.29	$21.55	$57.84
Truckdriver class 1(see notes)	5/1/2024		$36.79	$22.54	$59.33
Truckdriver class 2 (see notes)	5/1/2023		$36.39	$21.55	$57.94
Truckdriver class 2 (see notes)	5/1/2024		$36.89	$22.54	$59.43
Window Film / Tint Installer	6/1/2019		$24.52	$12.08	$36.60
Window Film / Tint Installer	6/1/2024		$26.37	$14.83	$41.20

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 24-10905 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Carpenter - Chief of Party (Surveying & Layout)	5/1/2023		$63.24	$29.06	$92.30
Carpenter - Chief of Party (Surveying & Layout)	5/1/2024		$65.19	$29.06	$94.25
Carpenter - Chief of Party (Surveying & Layout)	5/1/2025		$67.15	$29.06	$96.21
Carpenter - Chief of Party (Surveying & Layout)	5/1/2026		$69.10	$29.06	$98.16
Carpenter - Instrument Person (Surveying & Layout)	5/1/2023		$54.99	$29.06	$84.05
Carpenter - Instrument Person (Surveying & Layout)	5/1/2024		$56.69	$29.06	$85.75
Carpenter - Instrument Person (Surveying & Layout)	5/1/2025		$58.39	$29.06	$87.45
Carpenter - Instrument Person (Surveying & Layout)	5/1/2026		$60.09	$29.06	$89.15
Carpenter - Rodman (Surveying & Layout)	5/1/2023		$43.99	$22.41	$66.40
Carpenter - Rodman (Surveying & Layout)	5/1/2024		$45.35	$22.41	$67.76
Carpenter - Rodman (Surveying & Layout)	5/1/2025		$46.71	$22.41	$69.12
Carpenter - Rodman (Surveying & Layout)	5/1/2026		$48.07	$22.41	$70.48
Carpenter	5/1/2023		$54.99	$29.06	$84.05
Carpenter	5/1/2024		$56.69	$29.06	$85.75
Carpenter	5/1/2025		$58.49	$29.06	$87.55
Carpenter	5/1/2026		$60.19	$29.06	$89.25
Cement Masons	5/1/2023		$43.20	$32.91	$76.11
Dockbuilder, Pile Drivers	5/1/2023		$50.48	$37.99	$88.47
Dockbuilder, Pile Drivers	5/1/2024		$52.98	$37.99	$90.97
Dockbuilder, Pile Drivers	5/1/2025		$55.23	$37.99	$93.22
Dockbuilder, Pile Drivers	5/1/2026		$56.98	$37.99	$94.97
Dockbuilder/Pile Driver Diver	5/1/2023		$58.41	$41.74	$100.15
Dockbuilder/Pile Driver Diver	5/1/2024		$61.54	$41.74	$103.28
Dockbuilder/Pile Driver Diver	5/1/2025		$64.35	$41.74	$106.09
Dockbuilder/Pile Driver Diver	5/1/2026		$66.54	$41.74	$108.28
Dockbuilder/pile driver tender	5/1/2023		$50.48	$37.99	$88.47
Dockbuilder/pile driver tender	5/1/2024		$52.98	$37.99	$90.97
Dockbuilder/pile driver tender	5/1/2025		$55.23	$37.99	$93.22
Dockbuilder/pile driver tender	5/1/2026		$56.98	$37.99	$94.97
Electric Lineman	5/29/2023		$60.48	$32.77	$93.25
Electric Lineman	6/3/2024		$62.07	$33.96	$96.03
Iron Workers (Bridge, Structural, Ornamental, Precast)	1/1/2023		$50.70	$39.51	$90.21
Iron Workers (Bridge, Structural, Ornamental, Precast)	7/1/2024		$53.20	$45.01	$98.21
Iron Workers (Riggers)	7/1/2023		$42.53	$34.14	$76.67
Iron Workers (Rodman/Reinforcing)	7/1/2023		$45.70	$34.77	$80.47
Laborers (Class 01 - See notes)	5/1/2022		$36.30	$27.20	$63.50
Laborers (Class 01 - See notes)	5/1/2023		$37.55	$27.45	$65.00
Laborers (Class 01 - See notes)	5/1/2024		$38.80	$27.65	$66.45
Laborers (Class 02 - See notes)	5/1/2022		$36.50	$27.20	$63.70
Laborers (Class 02 - See notes)	5/1/2023		$37.75	$27.45	$65.20
Laborers (Class 02 - See notes)	5/1/2024		$39.00	$27.65	$66.65
Laborers (Class 03 - See notes)	5/1/2022		$36.50	$27.20	$63.70
Laborers (Class 03 - See notes)	5/1/2023		$37.75	$27.45	$65.20
Laborers (Class 03 - See notes)	5/1/2024		$39.00	$27.65	$66.65

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 24-10905 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Laborers (Class 04 - See notes)	5/1/2022		$31.10	$27.20	$58.30
Laborers (Class 04 - See notes)	5/1/2023		$32.35	$27.45	$59.80
Laborers (Class 04 - See notes)	5/1/2024		$33.60	$27.65	$61.25
Laborers (Class 05 - See notes)	5/1/2022		$37.15	$27.20	$64.35
Laborers (Class 05 - See notes)	5/1/2023		$38.40	$27.45	$65.85
Laborers (Class 05 - See notes)	5/1/2024		$39.65	$27.65	$67.30
Laborers (Class 06 - See notes)	5/1/2022		$37.20	$27.20	$64.40
Laborers (Class 06 - See notes)	5/1/2023		$38.40	$27.45	$65.85
Laborers (Class 06 - See notes)	5/1/2024		$39.70	$27.65	$67.35
Laborers (Class 07 - See notes)	5/1/2022		$37.05	$27.20	$64.25
Laborers (Class 07 - See notes)	5/1/2023		$38.30	$27.45	$65.75
Laborers (Class 07 - See notes)	5/1/2024		$39.55	$27.65	$67.20
Laborers (Class 08 - See notes)	5/1/2022		$36.80	$27.20	$64.00
Laborers (Class 08 - See notes)	5/1/2023		$38.05	$27.45	$65.50
Laborers (Class 08 - See notes)	5/1/2024		$39.30	$27.65	$66.95
Laborers (Class 09 - See notes)	5/1/2022		$36.65	$27.20	$63.85
Laborers (Class 09 - See notes)	5/1/2023		$37.90	$27.45	$65.35
Laborers (Class 09 - See notes)	5/1/2024		$39.15	$27.65	$66.80
Laborers (Class 10- See notes)	5/1/2022		$36.80	$27.20	$64.00
Laborers (Class 10- See notes)	5/1/2023		$38.05	$27.45	$65.50
Laborers (Class 10- See notes)	5/1/2024		$39.30	$27.65	$66.95
Laborers (Class 11 -See Notes)	5/1/2022		$36.70	$27.20	$63.90
Laborers (Class 11 -See Notes)	5/1/2023		$37.95	$27.45	$65.40
Laborers (Class 11 -See Notes)	5/1/2024		$39.20	$27.65	$66.85
Laborers (Class 12 -See Notes)	5/1/2022		$38.40	$27.20	$65.60
Laborers (Class 12 -See Notes)	5/1/2023		$39.65	$27.45	$67.10
Laborers (Class 12 -See Notes)	5/1/2024		$40.90	$27.65	$68.55
Laborers (Class 13 -See Notes)	5/1/2022		$40.43	$27.20	$67.63
Laborers (Class 13 -See Notes)	5/1/2023		$41.65	$27.45	$69.10
Laborers (Class 13 -See Notes)	5/1/2024		$42.93	$27.65	$70.58
Laborers (Class 14 -See Notes)	5/1/2022		$36.55	$27.20	$63.75
Laborers (Class 14 -See Notes)	5/1/2023		$38.25	$27.45	$65.70
Laborers (Class 14 -See Notes)	5/1/2024		$39.50	$27.65	$67.15
Laborers Utility (PGW ONLY) (Flagperson)	5/1/2023		$31.42	$19.43	$50.85
Laborers Utility (PGW ONLY) (Flagperson)	5/1/2024		$32.67	$19.63	$52.30
Laborers Utility (PGW ONLY)	5/1/2023		$38.45	$19.43	$57.88
Laborers Utility (PGW ONLY)	5/1/2024		$39.70	$19.63	$59.33
Landscape Laborer	5/1/2023		$29.03	$23.80	$52.83
Landscape Laborer	5/1/2024		$30.28	$24.05	$54.33
Millwright	5/1/2023		$51.60	$35.81	$87.41
Millwright	5/1/2024		$54.67	$35.81	$90.48
Millwright	5/1/2025		$57.39	$35.81	$93.20
Millwright	5/1/2026		$60.20	$35.81	$96.01
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2023		$52.20	$32.81	$85.01

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 24-10905 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2024		$53.36	$33.65	$87.01
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2025		$54.52	$34.49	$89.01
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2026		$55.67	$35.34	$91.01
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2023		$55.20	$33.70	$88.90
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2024		$56.37	$34.53	$90.90
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2025		$57.52	$35.38	$92.90
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2026		$58.68	$36.22	$94.90
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2023		$51.95	$32.74	$84.69
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2024		$53.11	$33.58	$86.69
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2025		$54.27	$34.42	$88.69
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2026		$55.43	$35.26	$90.69
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2023		$54.97	$33.61	$88.58
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2024		$56.13	$34.45	$90.58
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2025		$57.29	$35.29	$92.58
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2026		$58.44	$36.14	$94.58
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2023		$47.87	$31.53	$79.40
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2024		$49.03	$32.37	$81.40
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2025		$50.18	$33.22	$83.40
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2026		$51.34	$34.06	$85.40
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2023		$47.57	$31.44	$79.01
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2024		$48.73	$32.28	$81.01
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2025		$49.88	$33.13	$83.01
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2026		$51.04	$33.97	$85.01
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2023		$45.85	$30.93	$76.78
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2024		$47.00	$31.78	$78.78
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2025		$48.16	$32.62	$80.78
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2026		$49.32	$33.46	$82.78

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 24-10905 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2023		$44.85	$30.65	$75.50
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2024		$46.02	$31.48	$77.50
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2025		$47.17	$32.33	$79.50
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2026		$48.34	$33.16	$81.50
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2023		$63.33	$37.68	$101.01
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2024		$64.80	$38.61	$103.41
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2025		$66.26	$39.55	$105.81
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2026		$67.73	$40.48	$108.21
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2023		$63.04	$37.59	$100.63
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2024		$64.50	$38.53	$103.03
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2025		$65.97	$39.46	$105.43
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2026		$67.44	$40.39	$107.83
Painters - Line Stripping	12/1/2023		$42.10	$27.43	$69.53
Painters Class 2 (see notes)	2/1/2023		$48.82	$32.09	$80.91
Painters Class 2 (see notes)	2/1/2024		$49.57	$33.34	$82.91
Painters Class 3 (see notes)	2/1/2023		$59.78	$32.13	$91.91
Painters Class 3 (see notes)	2/1/2024		$60.53	$33.38	$93.91
Steamfitters (Heavy and Highway - Gas Distribution)	5/1/2022		$61.34	$40.28	$101.62
Steamfitters (Heavy and Highway - Gas Distribution)	5/1/2023		$64.00	$41.68	$105.68
Steamfitters (Heavy and Highway - Gas Distribution)	5/1/2024		$66.80	$42.93	$109.73
Truckdriver class 1(see notes)	5/1/2022		$35.45	$20.74	$56.19
Truckdriver class 1(see notes)	5/1/2023		$36.14	$21.55	$57.69
Truckdriver class 1(see notes)	5/1/2024		$36.64	$22.54	$59.18
Truckdriver class 2 (see notes)	5/1/2022		$35.55	$20.74	$56.29
Truckdriver class 2 (see notes)	5/1/2023		$36.24	$21.55	$57.79
Truckdriver class 2 (see notes)	5/1/2024		$36.74	$22.54	$59.28

BIDDER'S QUALIFICATIONS

All questions must be answered and the date given must be clear and comprehensive. This statement must be notarized. If necessary, questions may be answered on separate attached sheets. The Bidder may submit additional information if he so desires.

1. Name of Bidder:
2. Permanent main office address:
3. When Organized:
4. If a corporation, where incorporated:
5. How many years have you been engaged in the contracting business under your present firm or trade name?
6. Contracts on hand: Schedule these showing amount of each contract and the appropriate anticipated dates of completion.
7. General character of work performed by your company:
8. Have you ever failed to complete any work awarded to you? If so, where and why.
9. Have you ever defaulted on a contract? If so, where and why.
10. List the more important projects recently completed by your company, stating the approximate cost for each and the month and year completed.
11. List your major equipment available for this contract:
12. List experience in construction work similar in importance to this project:
13. List background and experience of the principal members of your organization, including the officers:
14. List credit available: $
15. List bank references:
16. Will you, upon request, fill out a detailed financial statement and furnish any other information which may be required by the Owner?
17. The undersigned hereby authorizes and requests any person, firm or corporation to furnish any information requested by the Owner in verification of the recitals comprising this Statement of Bidder's Qualifications.

Bidder: _____

By: _____

Title: _____

Dated this _____ day of _____, 20_____.

State of _____ §

County of _____:

_____ being duly sworn deposes and says that he is _____ of _____ and that the answers to the foregoing questions and all statements therein contained are true and correct.

Subscribed and sworn to before me this _____ day of _____, 20____.

_____ Notary Public

My commission expires: _____

COMMONWEALTH OF PENNSYLVANIA

PUBLIC WORKS EMPLOYMENT VERIFICATION FORM

Date _____

Business or Organization Name (Employer)_____

Address _____

City _____ State_____ Zip Code _____

☐ Contractor ☐ Subcontractor (check one)

Contracting Public Body _____

Contract/Project No _____

Project Description _____

Project Location _____

As a contractor/subcontractor for the above referenced public works contract, I hereby affirm that as of the above date, our company is in compliance with the Public Works Employment Verification Act ('the Act') through utilization of the federal E-Verify Program (EVP) operated by the United States Department of Homeland Security. To the best of my/our knowledge, all employees hired post January 1, 2013 are authorized to work in the United States.

It is also agreed to that all public works contractors/subcontractors will utilize the federal EVP to verify the employment eligibility of each new hire within five (5) business days of the employee start date throughout the duration of the public works contract. Documentation confirming the use of the federal EVP upon each new hire shall be maintained in the event of an investigation or audit.

I, _____, authorized representative of the company above, attest that the information contained in this verification form is true and correct and understand that the submission of false or misleading information in connection with the above verification shall be subject to sanctions provided by law.

_____

Authorized Representative Signature

DIVISION 01

GENERAL REQUIREMENTS

SECTION 011100 - SUMMARY

PART 1 - GENERAL

1.1 GENERAL

A. Only major items of work are given in the Bid Form, but it is the intent of the specifications to secure a completely interconnected and functionable system, and should any workmanship or materials be required which are obviously necessary to carry out the full intent and meaning of the plans and specifications or to be reasonably inferred therefrom, the cost of such workmanship or materials shall be included in the items in the bid form.

B. The Contractor, in the construction of the project, shall not stockpile materials or store equipment on any private property; except areas designated by the plans or as directed by the Engineer. If so required, the Engineer may direct the Contractor to have equipment removed from any project during weekend hours.

C. All notes on plans shall be made a part of the specifications.

D. The Contractor shall notify the Engineer at least forty-eight (48) hours in advance of any work scheduled for Saturdays.

E. All costs associated with the HVAC addition to the school cafeteria as detailed in the plans and specifications shall be included in the specific line items of the bid.

1.2 RELATED DOCUMENTS

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

1.3 PROJECT INFORMATION

A. Facility Owner Information:

1. Owner Name: Chester Upland School District

2. Engineer:

a. Mike Galante. mgalante@mgeassoc.com

b. Direct all questions to Engineer.

B. Facility Information:

1. Main Street Elementary School Building Location: 704 Main Street, Upland, PA 19015.

1.4 SUMMARY

A. Contract work includes the installation of a new HVAC system to serve the cafeteria in the Mainstreet School. The work will include supply and installation of one packaged DX/Gas HVAC unit, mounted on grade, connection to existing gas and electric services, demolition of existing ceiling, installation of new ceiling and light fixtures as indicated on the construction documents, and all associated work.

B. Additional work includes exterior concrete and fencing that is incidental to the installation of the HVAC Equipment. Upgrades to wiring and paneling within the electrical room will be coordinated during construction.

C. Section includes a summary of each contract, including responsibilities for coordination and temporary facilities and controls.

1.5 GENERAL REQUIREMENTS OF CONTRACTS

A. Extent of Contract: Unless the Agreement contains a more specific description of the Work of each Contract, requirements indicated on Drawings and in Specification Sections determine which contract includes a specific element of Project.

1. Unless otherwise indicated, the work described in this Section for each contract shall be complete systems and assemblies, including products, components, accessories, and installation required by the Contract Documents.
2. Blocking, backing panels, sleeves, and metal fabrication supports for the work of each contract shall be provided.
3. Furnishing of access panels for the work.
4. Cutting and Patching provided for the work
5. Through-penetration firestopping for the work.
6. Contractors' Startup Construction Schedule: Within five working days after startup horizontal bar-chart-type construction schedules showing construction operations sequenced and coordinated with overall construction.

B. Close-out Procedures: Contractor shall be responsible for:

a. Preparation and submission of Project Record Documents (as-builts, record specifications, record shop drawings, etc.) for work completed.
b. Preparation and submission of operation and maintenance manuals.
c. Assembly and submission of extra materials and attic stock to Owner.
d. Preparation and submission of warranties.

C. Type of Contract:

1. The project will be constructed under a multi-prime contract which will include an General, Mechanical and Electrical contractor.

1.6 REFER TO MULTIPLE CONTRACT SUMMARY FOR DETAILS FOR SCOPE OF EACH CONTRACT.

1.7 ACCESS TO SITE

A. Use of Site, Limited: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

1. Use of Site: Limit use of Project site to work in areas indicated and as directed by Owner. Do not disturb portions of Project site beyond areas in which the Work is indicated, including designated lay-down areas.

2. Driveways, Walkways and Entrances: Keep driveways, facility loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.

b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.8 COORDINATION WITH OCCUPANTS

A. Owner Occupancy: Owner will occupy site including existing and adjacent building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.

2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

1.9 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated.

1. Weekend Hours: As permitted by Owner..

2. Early Morning Hours: As permitted by Owner and local ordinance..

3. Hours for Utility or Services Shutdowns: As permitted by Owner..

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than two days in advance of proposed disruptive operations.

2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

F. Controlled Substances: Use of other controlled substances on the Project site is not permitted.

G. Employee Screening: Comply with Owner's requirements for background screening of Contractor personnel working on Project site.
   1. Maintain list of approved screened personnel with Owner's representative.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

   1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

   2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

   1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.

   2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

1.11 MAINTENANCE AND PROTECTION OF TRAFFIC

A. The Contractor shall erect or place and maintain in good condition, barricades, warning signs, lights, flares, approved yellow-flashing light units, rubber traffic cones, and other warning and danger signals and devices, appropriate and adequate for the specific needs and subject to the Engineer's approval, at working sites, necessary for the protection of pedestrian traffic.

B. The Contractor shall provide adequate means of access for fire, police and emergency vehicles throughout the length of the project. Contractor shall also provide for safe and adequate means of access to adjacent properties, both private and public.

C. The cost of all work as specified hereinbefore and all other work required to protect public safety and maintaining traffic flow shall be included in the prices bid for the Lump Sum Price Bid.

1.12 MATERIAL STORAGE AND REMOVAL

A. The Contractors are required to remove and dispose of materials in a lawful manner. Under no circumstance shall the contractor leave trash and debris around the perimeter of the site, and all material shall be stored in a dumpster or approved removal container. All costs shall be included in the lump sum price bid. The General Contractor is responsible for cleanliness of the site.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011200

SECTION 011200.01 - MULTIPLE CONTRACT SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes a summary of each contract, including responsibilities for coordination and temporary facilities and controls.

B. Specific requirements for Work of each contract are also indicated in individual Specification Sections and on Drawings.

C. Related Requirements:
   1. Section 013100 "Project Management and Coordination" for general coordination requirements.

1.3 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, the condition at which roofing is insulated and weathertight; exterior walls are insulated and weathertight; and openings are closed with permanent construction or substantial temporary closures equivalent in weather protection to permanent construction.

1.4 GENERAL REQUIREMENTS OF CONTRACTS

A. Extent of Contract: Unless the Agreement contains a more specific description of the Work of each Contract, requirements indicated on Drawings and in Specification Sections determine which contract includes a specific element of Project.

   1. Unless otherwise indicated, the work described in this Section for each contract shall be complete systems and assemblies, including products, components, accessories, and installation required by the Contract Documents.
   2. Blocking, backing panels, sleeves, and metal fabrication supports for the work of each contract shall be the work of the General Construction Contract
   3. Furnishing of access panels for the work of each contract shall be the work of each contract for its own work. Installation of access panels shall be the work of the General Construction Contract

4. Equipment pads for the work of each contract shall be the work of the General Construction Contract
5. Roof-mounted equipment curbs for the work of each contract shall be the work of the General Construction Contract
6. Painting for the work of each contract shall be the work of the General Construction Contract
7. Cutting and Patching: The General, Mechanical and Electrical Contractors are responsible for their cutting and patching necessary to install the complete HVAC System. However, Patching of all openings required for the installation of the new HVAC system will be the responsibility of the General Contractor.
8. Through-penetration firestopping for the work of each contract shall be provided by the General Contractor.
9. Contractors' Startup Construction Schedule: Within five working days after startup horizontal bar-chart-type construction schedules submittal has been received from Project coordinator, submit a matching startup horizontal bar-chart schedule showing construction operations sequenced and coordinated with overall construction.

B. Substitutions: Each contractor shall cooperate with other contractors involved to coordinate approved substitutions with remainder of the work.

C. Temporary Facilities and Controls: In addition to specific responsibilities for temporary facilities and controls indicated in this Section and in Section 015000 "Temporary Facilities and Controls," each contractor is responsible for the following:

1. Installation, operation, maintenance, and removal of each temporary facility necessary for its own normal construction activity, and costs and use charges associated with each facility, except as otherwise provided for in this Section.

D. Close-out Procedures: Each Prime Contractor shall be responsible for:

a. Preparation and submission of Project Record Documents (as-builts, record specifications, record shop drawings, etc.) for work completed.
b. Preparation and submission of operation and maintenance manuals.
c. Scheduling and conducting Owner’s training, and submitting record of training for materials and systems as specified.
d. Assembly and submission of extra materials and attic stock to Owner.
e. Preparation and submission of warranties, emergency contact information, and service contact information.

1.5 GENERAL CONSTRUCTION CONTRACT

A. Work of the General Construction Contract includes, but not limited to, the following:

1. Provide photographic documentation.
2. Provide quality-assurance and quality-control services
3. All required Sitework to include demolition, concrete, asphalt, curb, fencing and bollards.
4. Millwork
5. Ceiling replacement

6. General waste disposal facilities.
7. Barricades, warning signs, and lights.
8. Environmental protection.
9. All Final Patching of Mechanical and Electrical Contractors work.

1.6 MECHANICAL CONTRACT

A. Work of the MECHANICAL Contract includes, but is not limited to, the following:
   1. HVAC systems and equipment.
   2. HVAC instrumentation and controls.
   3. HVAC testing, adjusting, and balancing.
   4. Mechanical connections to equipment furnished by the General Construction Contract Electrical Contract.
   5. New gas service, new gas piping to HVAC equipment

1.7 ELECTRICAL CONTRACT

A. Work of the Electrical Contract includes, but is not limited to, the following:
   1. Electrical service replacement.
   2. Removal of ceiling mounted devices, lighting etc,
   3. New Lighting and lighting controls
   4. Emergency lighting and exit signage
   5. Electrical connections to equipment furnished by the HVAC Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011200.01

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:
   1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.

   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

   1. Substitution Request Form: Use form acceptable to Engineer.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

      a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
      b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
      c. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

d. Samples, where applicable or requested.
e. Certificates and qualification data, where applicable or requested.
f. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
g. Cost information, including a proposal of change, if any, in the Contract Sum.
h. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.

3. Engineer’s Action: If necessary, Engineer will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Engineer will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Engineer's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Engineer does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.7 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Requested substitution will not adversely affect Contractor's construction schedule.
c. Requested substitution has received necessary approvals of authorities having jurisdiction.
d. Requested substitution is compatible with other portions of the Work.

e. Requested substitution has been coordinated with other portions of the Work.
f. Requested substitution provides specified warranty.
g. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Engineer will consider requests for substitution if received within **60** days after the Notice to Proceed Requests received after that time may be considered or rejected at discretion of Engineer.

1. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documented and properly submitted.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
2. Section 013100 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

1.3 MINOR CHANGES IN THE WORK

A. Engineer will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710.

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Engineer will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Engineer are not instructions either to stop work in progress or to execute the proposed change.
2. Within 10 days, when not otherwise specified after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and

finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

e. Quotation Form: Use forms acceptable to Engineer.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Engineer.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Engineer

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Engineer will issue a Change Order for signatures of Owner and Contractor on **AIA Document G701**

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: **Engineer** may issue a Construction Change Directive on **AIA Document G714**. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:
1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Submit the schedule of values to Engineer at earliest possible date, but no later than 10 days before the date scheduled for submittal of initial Applications for Payment.
1. Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
2. Identification: Include the following Project identification on the schedule of values:
3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:

    a. Related Specification Section or division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.

1) Labor.
2) Materials.
3) Equipment.

4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
5. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
6. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Engineer, and paid for by Owner.

B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Times: Submit Application for Payment to Engineer by the 15 of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.

1. Submit draft copy of Application for Payment **seven** days prior to due date for review by Engineer.

D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

1. Other Application for Payment forms proposed by the Contractor may be acceptable to Engineer and Owner. Submit forms for approval with initial submittal of schedule of values.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. **Engineer** will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

G. Transmittal: Submit 1 signed and notarized original copies of each Application for Payment to **Engineer** electronically. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Products list (preliminary if not final).
5. Sustainable design action plans, including preliminary project materials cost data.
6. Schedule of unit prices.
7. Submittal schedule (preliminary if not final).
8. List of Contractor's staff assignments.
9. List of Contractor's principal consultants.
10. Copies of building permits.
11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
12. Initial progress report.
13. Report of preconstruction conference.
14. Certificates of insurance and insurance policies.
15. Performance and payment bonds.
16. Data needed to acquire Owner's insurance.

I. Application for Payment at Substantial Completion: After Engineer issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

    a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 017700 "Closeout Procedures."

2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Certification of completion of final punch list items.
3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
4. Updated final statement, accounting for final changes to the Contract Sum.
5. AIA Document G706.
6. AIA Document G706A.
7. AIA Document G707.
8. Evidence that claims have been settled.
9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
10. Proof that taxes, fees, and similar obligations are paid.
11. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Project meetings.

B. Related Requirements:

1. Section 011200 "Summary" for a description of the work
2. Section 013200 "Construction Progress Documentation"
3. Section 017300 "Execution"
4. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. BIM: Building Information Modeling.

B. RFI: Request for Information. Request from Owner, Engineer, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within **15** days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, in web-based Project software directory, and in prominent location in built facility. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and scheduled activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.6 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Engineer will return without response those RFIs submitted to Engineer by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Owner name.
3. Owner's Project number.
4. Name of Engineer
5. Engineer's Project number.
6. Date.
7. Name of Contractor.
8. RFI number, numbered sequentially.
9. RFI subject.
10. Specification Section number and title and related paragraphs, as appropriate.
11. Drawing number and detail references, as appropriate.
12. Field dimensions and conditions, as appropriate.
13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
14. Contractor's signature.
15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Engineer.

1. Attachments shall be electronic files in PDF format.

D. Engineer's Action: Engineer will review each RFI, determine action required, and respond. Allow ten days for Engineer's response for each RFI. RFIs received by Engineer after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Engineer's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.

2. Engineer's action may include a request for additional information, in which case Engineer's time for response will date from time of receipt by Engineer of additional information.
3. Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer in writing within **5** days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number.

1. Project name.
2. Name and address of Contractor.
3. Name and address of Engineer
4. RFI number, including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Engineer's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

F. On receipt of Engineer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Engineer within **seven** days if Contractor disagrees with response.

1.7 PROJECT MEETINGS

A. General: **Schedule and conduct** meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times a minimum of **seven** days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Engineer, within **three** days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Engineer, but no later than 15 days after execution of the Agreement.
1. Agenda: Discuss items of significance that could affect progress, including the following:

a. Responsibilities and personnel assignments.
b. Tentative construction schedule.
c. Phasing.
d. Critical work sequencing and long lead items.
e. Designation of key personnel and their duties.
f. Lines of communications.
g. Procedures for processing field decisions and Change Orders.
h. Procedures for RFIs.
i. Procedures for testing and inspecting.
j. Procedures for processing Applications for Payment.
k. Distribution of the Contract Documents.
l. Submittal procedures.

m. Project closeout requirements and sustainable design certification procedures.
n. Construction waste management.
o. Construction operations and sustainable design requirements and restrictions.
p. Preparation of Record Documents.
q. Use of the premises
r. Work restrictions.
s. Working hours.
t. Owner's occupancy requirements.
u. Responsibility for temporary facilities and controls.
v. Procedures for moisture and mold control.
w. Procedures for disruptions and shutdowns.
x. Construction waste management and recycling.
y. Parking availability.
z. Office, work, and storage areas.
aa. Equipment deliveries and priorities.
bb. First aid.
cc. Security.
dd. Progress cleaning.

2. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.

1. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
2. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.

D. Project Closeout Conference: **Schedule and conduct** a project closeout conference, at a time convenient to Owner and Engineer, but no later than **90** days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority**,** Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of Record Documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Submittal of written warranties.
d. Requirements for delivery of material samples, attic stock, and spare parts.
e. Preparation of Contractor's punch list.

f. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
g. Submittal procedures.
h. Coordination of separate contracts.
i. Owner's partial occupancy requirements.
j. Installation of Owner's furniture, fixtures, and equipment.
k. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at biweekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner**,** Owner's Commissioning Authority and Engineer, each contractor, subcontractor, supplier, and 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 meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

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

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:
1) Status of submittals.
2) Deliveries.
3) Access.
4) Site use.
5) Temporary facilities and controls.
6) Progress cleaning.
7) Quality and work standards.
8) Status of correction of deficient items.
9) Field observations.
10) Status of RFIs.
11) Status of Proposal Requests.
12) Pending changes.
13) Status of Change Orders.
14) Pending claims and disputes.
15) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Concealed Work photographs.
3. Periodic construction photographs.
4. Final Completion construction photographs.

B. Related Requirements:

1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.

1.3 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each **photograph**. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within 5 days of taking photographs.

1. Submit photos **by uploading to project management site**. Include copy of key plan indicating each photograph's location and direction.
2. Identification: Provide the following information with each image description **in web-based Project management site**:

a. Name of Project.
b. Name and contact information for photographer.
c. Name of Engineer
d. Name of Contractor.
e. Date photograph was taken.
f. Description of location, vantage point, and direction.
g. Unique sequential identifier keyed to accompanying key plan.

1.4 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs with maximum depth of field and in focus.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by **Engineer.**

1. Flag excavation areas before taking construction photographs.
2. Take 5 photographs to show existing conditions adjacent to property before starting the Work.
3. Take 20 photographs of existing buildings either on or adjoining property, to accurately record physical conditions at start of construction.
4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

C. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work.

D. Periodic Construction Photographs: Take **20** photographs **weekly**. Select vantage points to show status of construction and progress since last photographs were taken.

E. Final Completion Construction Photographs: Take **50** photographs after date of Substantial Completion for submission as Project Record Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:
1. Section 013100 "Project Management and Coordination"
2. Section 013200 "Construction Progress Documentation" f
3. Section 013233 "Photographic Documentation"
4. Section 014000 "Quality Requirements"
5. Section 017700 "Closeout Procedures"
6. Section 017839 "Project Record Documents"

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Engineer and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.

a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.

2. Format: Arrange the following information in a tabular format:

a. Scheduled date for first submittal.

b. Specification Section number and title.
c. Submittal Category: Action; informational.
d. Name of subcontractor.
e. Description of the Work covered.
f. Scheduled date for Engineer's final release or approval.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Engineer.
4. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
5. Category and type of submittal.
6. Submittal purpose and description.
7. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
8. Drawing number and detail references, as appropriate.
9. Indication of full or partial submittal.
10. Location(s) where product is to be installed, as appropriate.
11. Other necessary identification.
12. Remarks.
13. Signature of transmitter.

B. Options: Identify options requiring selection by Engineer.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Engineer on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

E. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package and transmit to Engineer by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Engineer.

a. Engineer will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.

2. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Engineer's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer's and Construction Manager's action stamp.

1.6 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams that show factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data**.**

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Identification of products.
    b. Schedules.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.
    e. Notation of dimensions established by field measurement.
    f. Relationship and attachment to adjoining construction clearly indicated.
    g. Seal and signature of professional engineer if specified.

C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:

    a. Project name and submittal number.
    b. Generic description of Sample.
    c. Product name and name of manufacturer.
    d. Sample source.
    e. Number and title of applicable Specification Section.
    f. Specification paragraph number and generic name of each item.
3. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit **one** full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Engineer, will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit **three** sets of Samples. Engineer will retain **two** Sample sets; remainder will be returned.

        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least **three** sets of paired units that show approximate limits of variations.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of Engineers and owners, and other information specified.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.7 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp, and indication in web-based Project management software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

    1. Engineer will not review submittals received from Contractor that do not have Contractor's review and approval.

1.8 ENGINEER'S REVIEW

A. Action Submittals: Engineer will review each submittal, indicate corrections or revisions required.

    1. PDF Submittals: Engineer will indicate, via markup on each submittal, the appropriate action.
        1) APPROVED: The work involved may proceed, and no further submission is required.
        2) APPROVED AS NOTED: The work involved may proceed incorporating comments. Annotations do not authorize changes to Contract Sum.
        3) REVISE AND RESUBMIT: The work involved may not proceed. Submittal must be corrected and resubmitted.

4) REJECTED: The submittal is not in accordance with the Contract Documents, and a completely new submittal is required

2. Submittals by Web-Based Project Management Software: Engineer will indicate, on Project management software website, the appropriate action.

a. Actions taken by indication on Project management software website have the following meanings:
1) APPROVED: The work involved may proceed, and no further submission is required.
2) APPROVED AS NOTED: The work involved may proceed incorporating comments. Annotations do not authorize changes to Contract Sum.
3) REVISE AND RESUBMIT: The work involved may not proceed. Submittal must be corrected and resubmitted.
4) REJECTED: The submittal is not in accordance with the Contract Documents, and a completely new submittal is required

B. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents will be returned by Engineer without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and quality-control services required by Engineer, Owner, **Commissioning Authority,** or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of **five** previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.

1. Mockups are used for one or more of the following:

    a. Verify selections made under Sample submittals.
    b. Demonstrate aesthetic effects.
    c. Demonstrate the qualities of products and workmanship.
    d. Demonstrate successful installation of interfaces between components and systems.
    e. Perform preconstruction testing to determine system performance.
2. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."

I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Engineer.

1.4 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.

2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

E. Reports: Prepare and submit certified written reports and documents as specified.

F. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.5 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within **10** days of **Notice to Proceed**, and not less than five days prior to preconstruction conference. Submit in format acceptable to Engineer. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.

B. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

C. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.

D. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Engineer has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.6 REPORTS AND DOCUMENTS

A. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.

4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement of whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

1.7 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

1.8 QUALITY CONTROL

A. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Engage a qualified testing agency to perform quality-control services.
3. Notify testing agencies at least **24** hours in advance of time when Work that requires testing or inspection will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and

provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
6. Security and protection for samples and for testing and inspection equipment at Project site.

C. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.3 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Implementation and Termination Schedule: Within **15** days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed.

F. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil (0.25-mm) minimum thickness, with flame-spread rating of 15 or less in accordance with ASTM E84 and passing NFPA 701 Test Method 2.

B. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches (914 by 1524 mm).

2.2 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. General: Install temporary service or connect to existing service.

C. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project Area. Provide temporary, directional signs for construction personnel and visitors.

D. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

E. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."

F. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.

G. Temporary Heat and Ventilation
   1. Provide temporary heat as necessary for protection or completion of the Work.
   2. Provide temporary heat and ventilation to assure safe working conditions; maintain enclosed areas at a minimum of 50°F.

3.2 FIELD OFFICE

A. Provision of a field office is not required unless specified in the conditions of this contract. If the Contractor chooses to provide one, locate it in a place approved by the Owner Representative.

3.3 STORAGE OF MATERIALS

A. Provide adequately ventilated, watertight storage facilities with floor above ground level for materials and equipment susceptible to weather damage.

B. Storage of materials not susceptible to weather damage may be on blocks off the ground.

C. Store materials in a neat and orderly manner. Place materials and equipment to permit easy access for identification, inspection and inventory.

D. Contractor is responsible for materials and equipment stored on and off site.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

   1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

   1. Comply with work restrictions specified in Section 011000 "Summary."

C. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.

D. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

1. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
2. Paint and maintain appearance of walkway for duration of the Work.

E. Temporary Enclosures: Construct dustproof partitions with gypsum wallboard, with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
1. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
2. Provide walk-off mats at each entrance through temporary partition.

F. Controlled Construction Period: After completing and sealing of the building enclosure but

G. Protection Of Installed Products.
1. Provide protection of installed products to prevent damage from subsequent operations. Remove protection facilities when no longer needed, prior to completion of Work.
2. Control traffic to prevent damage to equipment, materials, and surfaces.

H. Roads And Parking
1. Prevent interference with traffic and Owner operations on existing roads.
2. Designate temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking. Locate as approved by Owner.
3. Minimize use by construction traffic of existing residential streets and driveways.
4. Do not allow heavy vehicles or construction equipment in existing parking areas.

I. Environmental Controls
1. Provide and maintain methods, equipment, and temporary construction as necessary for controls over environmental conditions at the construction site and adjacent areas.
2. Comply with statutes, regulations, and ordinances which relate to the proposed Work for the prevention of environmental pollution and preservation of natural resources, including but not limited to the National Environmental Policy Act of 1969, PL 91-190, Executive Order 11514.
3. Burning of rubbish, debris or waste materials is not permitted.

J. Pollution Control
1. Provide methods, means, and facilities required to prevent contamination of soil, water or atmosphere by discharge of noxious substances from construction operations.
2. Provide equipment and personnel to perform emergency measures required to contain any spillage, and to remove contaminated soils or liquids. Excavate and dispose of any contaminated earth off-site in accordance with laws and regulations, and replace with suitable compacted fill and topsoil.
3. Take special measures to prevent harmful substances from entering public waters. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams, or in sanitary or storm sewers.
4. Provide systems for control of atmospheric pollutants. 1. Prevent toxic concentrations of chemicals.

a. Prevent harmful dispersal of pollutants into the environment.

5. Use equipment during construction that conforms to current Federal, State, and local laws and regulations.

K. Pest And Rodent Control

1. Provide rodent and pest control as necessary to prevent infestation of construction or storage areas.
2. Employ methods and use materials which will not adversely affect conditions at the site or on adjoining properties.

L. Noise Control

1. Provide vehicles, equipment, and construction activities that minimize noise to the greatest degree practicable. Noise levels shall conform to the latest OSHA standards and Township Ordinances and in no case will noise levels be permitted which create a nuisance in the surrounding neighborhoods.
2. Conduct construction operations during daylight hours except as approved by Owner Representative.

M. Dust Control

1. Control objectionable dust caused by operation of vehicles and equipment. Apply water or use other methods, subject to approval of the Owner Representative, which will control the amount of dust generated.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Section 011000 "Summary" for Contractor requirements related to Owner-furnished products.
2. Section 012500 "Substitution Procedures" for requests for substitutions.
3. Section 01770 "Closeout Procedures" for submitting warranties.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."

F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.
b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Engineer will determine which products shall be used.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.

2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

    a. Name of product and manufacturer.
    b. Model and serial number.
    c. Capacity.
    d. Speed.
    e. Ratings.

3. See individual identification Sections in Divisions -22, and 26 for additional equipment identification requirements.

1.5 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

C. Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.

6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
3. Where products are accompanied by the term "as selected," Engineer will make selection.
4. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
5. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

a. Submit additional documentation required by Engineer in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Engineer, whose determination is final.

B. Product Selection Procedures:

1. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."

2. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience **will** be considered

a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."

3. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require the phrase "match Engineer's sample," provide a product that complies with requirements and matches Engineer's sample. Engineer's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Engineer from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Engineer will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

E. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements in Division 01 sustainability requirements Section and individual Specification Sections.

1. Select products for which sustainable design documentation submittals are available from manufacturer.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer may return requests without action, except to record noncompliance with the following requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects, with project names and addresses and names and addresses of Engineers and owners, if requested.
5. Samples, if requested.

B. Engineer's Action on Comparable Products Submittal: If necessary, Engineer will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."

1. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
2. Use product specified if Engineer does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Two-Step Process: Approval by the Engineer of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:
   1. Installation of the Work.
   2. Cutting and patching.
   3. Coordination of Owner-installed products.
   4. Progress cleaning.
   5. Starting and adjusting.
   6. Protection of installed construction.
   7. Correction of the Work.

B. Related Requirements:
   1. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.3 QUALITY ASSURANCE

A. Professional Engineer Qualifications: Refer to Section 014000 "Quality Requirements."

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
   1. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

B. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility

appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

B. Install products at the time and under conditions that will ensure satisfactory results as judged by Engineer. Maintain conditions required for product performance until Substantial Completion.

C. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.

D. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

E. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

F. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

G. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Engineer. Fit exposed connections together to form hairline joints.

3.4 CUTTING AND PATCHING

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

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of Work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to **minimize** interruption to occupied areas.

F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Engineer. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: 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.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.5 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

C. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

D. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

E. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

F. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

G. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

H. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.6 CORRECTION OF THE WORK

A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Restore permanent facilities used during construction to their specified condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
2. Section 013233 "Photographic Documentation" for submitting Final Completion construction photographic documentation.
3. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

1.3 DEFINITIONS

A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Engineer's use prior to Engineer's inspection, to determine if the Work is substantially complete.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.5 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest-control inspection.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of **10** days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
3. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by **Engineer**. Label with manufacturer's name and model number.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of **10** days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of **10** days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or

additional items identified by Engineer, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Submit Final Completion photographic documentation.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Engineer, will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Engineer,
    d. Name of Contractor.

e. Page number.

4. Submit list of incomplete items in the following format:

a. MS Excel Electronic File: Engineer, will return annotated file.
b. Web-Based Project Software Upload: Utilize software feature for creating and updating list of incomplete items (punch list).

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Engineer for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit on digital media acceptable to Engineer, by uploading to web-based project software site.

D. Warranties in Paper Form:

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

E. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
b. Remove tools, construction equipment, machinery, and surplus material from Project site.
c. Remove snow and ice to provide safe access to building.
d. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
e. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
f. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
g. Remove labels that are not permanent.
h. Wipe surfaces of mechanical and electrical equipment**,** elevator equipment**,** and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
i. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
j. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
k. Clean ducts, blowers, and coils, if units were operated without filters during construction or that display contamination with particulate matter on inspection.

l. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
m. Clean strainers.
n. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste-disposal requirements in Section 015000 "Temporary Facilities and Controls." Section 017419 "Construction Waste Management and Disposal.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations required by Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 017700

017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing, product maintenance manuals.

B. Related Requirements:

1. Section 011200 "Multiple Contract Summary" for coordinating operation and maintenance manuals covering the Work of multiple contracts.
2. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
3. Section 019113 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Engineer will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

1. Submit on digital media acceptable to Engineer, by uploading to web-based project software site. Enable reviewer comments on draft submittals.

2. .

C. Initial Manual Submittal: Submit draft copy of each manual at least **30**days before commencing demonstration and training. Engineer will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 1**5** days before commencing demonstration and training. Engineer will return copy with comments.

1. Correct or revise each manual to comply with Engineer's comments. Submit copies of each corrected manual within **15** days of receipt of Engineer's and prior to commencing demonstration and training.

E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.6 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.

5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:
1. Section 017700 "Closeout Procedures" for general closeout procedures.
2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
1. : Submit copies of Record Drawings as follows:

a. Initial Submittal:
1) Submit PDF electronic files of scanned record prints
2) Submit Record Digital Data Files
3) Engineer will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:
1) Submit PDF electronic files of scanned Record Prints
2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit **annotated PDF electronic files** of Project's Specifications, including addenda and Contract modifications.

C. Record Product Data: Submit **annotated PDF electronic files and directories** of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit **annotated PDF electronic files and directories** of each submittal.

E. Reports: Submit written report **weekly** indicating items incorporated into Project Record Documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.4 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

B. Format: Submit record specifications as **annotated PDF electronic file**

1.5 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in

C. Format: Submit Record Product Data as **annotated PDF electronic file**.

1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017839

TECHNICAL DIVISIONS

SECTION 00000
SCOPE OF WORK

PART 1 - GENERAL

1.01 Site Location

A. The project site is located in the Upland Borough, Delaware County, Pennsylvania. The site location is Main Street Elementary School at 704 Main Street, Upland, PA 19015.

1.02 Project Description

A. The Chester Upland School District is proposing to install a new HVAC system within the Cafeteria, a new window unit in the Annex Classroom, and incidental electrical upgrades. Incidental work will include electrical connections, concrete removal and replacement for new HVAC pad, chain-link fence and bollard installation. The contractor will be required to obtain a building permit for the work and the permit cost will be included within the bid allowance item.

MECHANICAL CONSTRUCTION WORK

A. Provide new 17-ton packaged DX/Gas unit, to be installed on grade. General contractor to provide a new 4" concrete pad outdoors, traffic bollards, and a chain-link fence around the unit.
B. Provide new natural gas piping. Tap off of the existing gas meter, and provide new shut-off and regulator.
C. Provide new insulated supply and return ductwork, and air devices as shown on the plans.
D. Existing ceiling in the cafeteria is to be removed and replaced with new, by the General Contractor. New ceiling shall provide 18 inches clear above the ceiling for installation of the new ductwork.
E. Install new programmable thermostat and CO2 sensors. Provide unit with stand-alone DDC controls.

ELECTRICAL CONSTRUCTION WORK

A Provide new 125 Amp, 3-Pole overcurrent protection device in the space available in existing Panel "HVAC2" to serve new 200 Amp Frame, 110 Amp Trip disconnecting means located adjacent the new, grade-mounted Air Handling Unit via new 4#1+1#6 GND in 1-½" C.
B Upgrade wiring methods associated with existing window Air Conditioning equipment. Wiring method upgrades are limited to 16 units which have been malfunctioning due to voltage drop.
C Luminaires within the cafeteria are to be replaced with new, 2'x2' illuminated panels. New luminaires are to be served via the existing branch circuit wiring and controls.

GENERAL CONSTRUCTION WORK

a. The General Construction Work will include the demolition of existing features to make way for new improvements. This shall include concrete and asphalt removal for new HVAC Unit and demolition of ceiling grid to make way for new mechanical improvements. General Construction work includes patching openings, in kind for the electrical and HVAC Contractors. Quality tradesmen are required to complete patching and all openings must be sealed and weatherproofed.

b. The General Contractor is required to install a concrete pad which shall consist of a 4" 2A stone subbase, 8" Reinforced Concrete Pad, 4" Concrete sidewalk with a 4" 2A stone subbase, and asphalt pavement improvements. Work also includes the installation of 4" steel bollards and black vinyl coated chain-link fence in accordance with the Site Plan documents.

c. Asphalt restoration shall include installation of 4" of 2A Stone Base, 2.5" Asphalt Binder Course, and 1.5" Asphalt Wearing Course.

d. Contractor shall include all mobilization and demobilization costs within their bid.

e. An allowance has been added to the bid for unforeseen conditions and permit costs.

f. Contractor shall secure the construction area with temporary fencing.

1.02 General Requirements

A. The construction layout of all proposed elements of construction shall be to the specified lines and grades. All limits of work shall be marked out and approved by the District Engineer prior to excavation. Grades shall be verified in the field during construction layout.

B. The removal of existing features as incidental to the contract work items shall be completed, including but not limited to the following: metal plates, pipes, concrete slabs, stone, bricks, and all foreign materials encountered during the excavation for contract items.

1.05 Additional Requirements

A. All Base Bid work by the Contractor must be 100% complete within the contract time limit of 120 calendar days. The contract time limit shall begin once a written Notice to Proceed order has been issued to the contractor.

B. The cost of all related incidental work, dust control, cleaning and restorations shall be included in the various unit prices bid. These activities are not separate pay items.

C. All materials, construction procedures, type and use of equipment, measurement and payment shall be in accordance with the Commonwealth of Pennsylvania Department of Transportation Specifications, Publication 408, unless otherwise noted and/or modified by these specifications.

D. The contractor is responsible for the construction layout of this project. The contractor shall forward all construction layout survey information to the District Engineer for reference including: benchmarks, stationing, and elevations.

E. All contractors and other persons utilizing this specification and the information contained herein are cautioned to comply with the requirements of Pennsylvania Act 172, entitled "Excavation and Demolition Work Protection of Underground Utilities." Each individual contractor using the project plans must verify the location and depth of all underground utilities and facilities before starting work. The contractor shall notify "PA One Call" (1-800-242-1776) at least 72 hours prior to the start of any excavation.

F. The contractor shall establish contact with an individual from each local utility prior to commencement of excavation. The contractor shall notify the Engineer and the utility owner immediately should a conflict occur in the limits of construction. The contractor shall be responsible for coordination of all work to be performed by the utility owner with regards to the work included in this contract. Additional payment will not be made for any delays incurred or any additional work performed due to conflicts with existing utility mains or service lines.

G. All paved asphalt or concrete areas disturbed during construction shall be restored to a condition at least equal to that which existed prior to the start of construction.

H. All fill shall be placed in twelve inch (12") thick lifts and thoroughly compacted to the satisfaction of the Engineer. If borrow fill is required, it shall be subject to the approval of the District Engineer.

I. The contractor shall be responsible for the location and preservation of underground and surface utilities and structures at, or adjacent to, the site of construction. It shall be at the contractor's own expense to repair or replace anything that is damaged by the contractor.

J. All construction details not shown shall be in accordance with PennDOT standards as detailed in:
    1. PennDOT Specifications, Pub. 408, latest revision
    2. PennDOT Standards for Roadway Construction, Pub. 72, latest revision

    These standards can be purchased at: PA Department of Transportation, Sales Store, P.O. Box 2028, Harrisburg, PA 17105-2028, (717-787-6746).

K. Work shall be in accordance with all Federal, State and Local Regulations. Contractor must abide by all local building codes.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

PART 4 – QUANTITY AND PAYMENT

Not Used

END OF SECTION

CONTENTS

DIVISION 21 - FIRE SUPPRESSION
DIVISION 22 - PLUMBING
DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

SECTION	TITLE
22 05 00	STANDARD CONDITIONS FOR PLUMBING
22 17 00	GAS PIPING SYSTEMS
23 05 00	STANDARD CONDITIONS FOR HVAC WORK
23 05 13	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
23 05 48.13	VIBRATION CONTROLS FOR HVAC
23 05 50	FIRE STOPPING
23 05 53	IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
23 05 93	TESTING, BALANCING, AND ADJUSTING
23 07 13	DUCT INSULATION
23 09 33	AUTOMATIC TEMPERATURE CONTROL
23 31 13	METAL DUCTS
23 33 00	AIR DUCT ACCESSORIES
23 33 46	FLEXIBLE DUCTS
23 37 13 .13	AIR DIFFUSERS
23 37 13. 23	REGISTERS AND GRILLES
23 74 16.13	PACKAGED, MID-CAPACITY, GAS FIRE ROOFTOP UNITS (12.5-25 TONS)

DIVISION 22 - PLUMBING

SECTION 22 05 00 - STANDARD CONDITIONS FOR PLUMBING

PART 1 - GENERAL

1.01 REFERENCE

A. Requirements established within the portions of this project manual titled Division 1, General Requirements are collectively applicable to the work of this section.
B. Instructions to Bidders, Special Conditions and addenda as issued are part of this specification.
C. Plumbing drawings along with all other project drawings and specifications represent the work of this section.
D. Drawings, Contract, General Conditions and Supplementary Conditions form a part of this section, by reference thereto and shall have the same force and effect as if printed herewith in full. Failure to review these sections shall not relieve the Contractor of his responsibility to fully comply with the terms therein.

1.02 SCOPE

A. Provide labor, material, equipment, and supervision necessary to install complete operating plumbing systems as indicated on the drawings and specified herein, including all work at the site and within the proposed construction areas to accomplish the required work.
B. It shall be the contractor’s responsibility to coordinate his work and the work of his subcontractors to insure that all the work is covered. He shall designate who is responsible for various portions of work which may overlap so that there is complete coverage of all required work. It is the position of the owner and the A/E that all work is the responsibility of the mechanical contractor within this division of the work.
C. All work shown on the drawings and not expressly mentioned in the specifications and all work specified but not shown on the drawings, but necessary for the proper execution of same shall be performed by the contractor. It is not the intent of the drawings and specifications to describe every feature and detail of the work.
D. No additions to the contract amount will be approved for any materials, equipment, or labor to perform additional work unless it can be clearly shown to be beyond the scope and intent of the drawings and specifications.
E. Plumbing contractor's scope of work shall include but not be limited to the following:
    1. Fuel gas piping.
    2. Demolition of existing work to accommodate new work.
    3. Repair existing areas affected by new construction. Patch, repair, and finish to match existing.
    4. Fire stopping of penetrations. (See Section 22 05 50).

1.03 REGULATIONS, CODES, AND STANDARDS

A. Work shall be performed in accordance with the latest adopted codes, amendments,

regulations, and ordinances of the authorities having jurisdiction. Observe all safety regulations including the requirements of OSHA.

B. Obtain and pay for all permits, connection charges, inspections, and certificates required to complete the work.

C. Latest editions of any referenced standards shall govern.

D. Contractor shall arrange and pay for all tests and inspections specified herein or required by above agencies and furnish required certificate of inspection to owner.

E. Where the contract documents are more stringent but not in conflict with the applicable codes, the more stringent requirements shall be followed.

1.04 SUBMISSIONS

A. The procedure for submissions of shop drawings shall be as specified in Division 1, or as a minimum, as indicated below.

B. Furnish submissions of shop drawings and samples of materials and equipment as indicated in these sections, on the drawings, or as directed by the A\E. Submissions will be made in a timely fashion such that adequate time exists to review the drawings, or material, and arrive at the site in accordance with the project schedule.

C. Submissions will not be accepted with work defined as "By Others". Identify contractor by name and with his approval so indicated. Submissions are required prior to purchasing, fabrication, or installation of any material or equipment. Submissions shall be reviewed and certified by the submitting contractor that they are in accordance with the project documents.

D. When requested by the engineer, shop drawings shall be required to be submitted to designated agencies for review and approval prior to submission to the engineer.

E. Contractor shall arrange and pay for all tests and inspections specified herein or required by above agencies and furnish required certificate of inspection to owner.

F. Contractor to forward a copy of submittals which have electrical requirements to the Electrical Contractor (EC) for coordination of voltage, amperage, and phase. Response to be received from EC prior to ordering of equipment by mechanical contractor.

G. Submissions shall include warrantees by the manufacturer for equipment being provided. Submissions for commonly related items such as fixtures, trim, carriers, drains shall be combined in a single brochure with all items being furnished clearly identified.

H. Shop drawings and submittals shall be checked and stamped by the contractor before submitting. They shall conform to measurements made at the site, the contract requirements, and coordinated with all other trades.

I. Specific models in catalog sheets must be identified as well as all options, voltages, phases, etc. identified so as to be clear on what is being provided.

J. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.

K. To aid in the preparation of submittals or shop drawings, the engineer can provide the electronic files for use by the contractor. The electronic files will be provided upon execution of the engineer’s electronic file release contract prepared specifically for this project. The electronic files will be released in the format used by the architect and engineer to design the project. If this file format is not compatible with the contractor’s needs, additional charges for providing the changes to the requested file format may be necessary at $150/hr. billable to

the contractor.

1.05 SITE INSPECTION

A. Visit site, inspect and become aware of all conditions which may affect the work. Investigate utilities, protection requirements for adjacent facilities, storage locations, and access to the construction area.
B. Submission of bid will be deemed evidence of having complied with this request. Contractor may not request additional costs for existing conditions which were evident from inspection of the site.

1.06 SUBSTITUTIONS

A. Material and equipment specified shall be deemed as that which the bidder's quotation represents the contractor.
B. Once bids are accepted only that material and equipment listed in the specifications or added by addenda shall be acceptable. Substitution information for inclusion in an addenda must be received by the A\E at least 10 days prior to bid opening. If acceptable, an addenda will be issued which will add the additional acceptable manufacturers or materials and be available for all contractors to consider. It shall be a basic premise that a contractor is a lowest bidder because he utilized substituted materials or equipment as opposed to specified materials or equipment.
C. If the contractor submits alternate equipment, manufacturers, systems, methods, or materials, not specifically identified in the specifications, additional review and investigation time may be required by the engineer. If the engineer determines additional review time is required because of the substitution, then this will be a billable service by the engineer at the rate of $150.00/hr. for such services. Also, billable will be any redesign time and revisions to drawings should they be necessary for incorporation into the work. Services will be billable to the contractor making such substitutions and will be payable prior to approval or rejection.
D. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.

1.07 DRAWINGS AND SPECIFICATIONS

A. The drawings are generally diagrammatic and necessary field coordination and adjustment must be provided by the contractor prior to installation. Such deviations to the work to allow for coordination shall be kept to a minimum and any such deviations shall be at no extra cost.
B. When a conflict or contradiction exists either between drawings and specs or between specs or between different drawings or details, the more stringent shall apply.
C. Drawings and specifications are intended to be taken as a whole and each is to supplement the other. It is not intended that all work must be both shown on drawings and specified in the specifications.
D. An item shown on the drawings and not indicated in the specifications is to be understood to

be required for the project. An item specified and not shown on the drawings is to be understood to be required for the project.

E. The architects or engineer's interpretation of the documents shall be binding upon the contractor. If a question arises, the contractor shall ask for an interpretation prior to bidding and an answer shall be issued as an addendum to all bidders.

F. If a question arises after bidding the A/E interpretation shall govern.

1.08 MEASUREMENTS

A. Before ordering materials or commencing with any work, the contractor shall verify all measurements at the building. Coordination of equipment, materials, spaces, and dimensions are the responsibility of the contractor.

1.09 PROGRESS SCHEDULE

A. Provide a project schedule which shall show start, sequence of each type of work, milestone schedule, and completion of each type of work, with overall completion date.

1.10 COST SCHEDULE

A. Provide a detailed cost breakdown indicating labor and material amounts for various types of work.

B. AIA forms are required for this submission.

1.11 COMPLETION

A. The contractor shall deliver to the owner, with his request for final payment, copies of all manufacturer's guarantees, equipment instructional manuals, a complete set of all final shop drawings, catalog cuts, service contracts, and other items as may be required elsewhere in the documents.

1.12 OFFICE

A. The contractor shall set up his job office (desk) where directed by the owner.

1.13 STORAGE

A. Material shall be stored only where directed by the owner.

1.14 SANITARY

A. The contractor will at his own expense, provide and maintain in a sanitary condition, a portable chemical toilet.

B. Toilet will be located where directed by the owner.

PART 2 - PRODUCTS

2.01 GENERAL

A. All material shall be new and of present day manufacture.
B. All material and equipment shall be in conformance with accepted trade standards.
C. 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 may be necessary to complete the installation.
D. The word “provide” means “furnish and install complete, tested, and adjusted as necessary with all accessories, covers, escutcheons”. The word “piping” means pipe, fitting, controls, valves and hangers as required for a complete system.

2.02 OPERATING INSTRUCTIONS AND MANUALS

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. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalogue cuts, wiring diagrams, control sequences, service requirements, piping diagrams, names, and addresses of vendors, suppliers and emergency contacts. Three manuals shall be provided.
E. Provide to the owner any special tools necessary to operate any of the equipment.

PART 3 - EXECUTION

3.01 PROTECTION

A. Plug or cap open ends of piping systems and conduit.
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. Cover plumbing fixtures.
D. Do not install plates, polished metal escutcheons, and other finished devices until masonry, tile, and painting operations are complete or protect otherwise.
E. Protect all existing or new work from operations which may cause damage such as hauling, welding, soldering, painting, insulating, and covering.

3.02 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.

3.03 FASTENERS, HANGERS, AND SUPPORTS

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

B. Furnish and install all miscellaneous steel angles, channels, beams, clips, brackets, and anchors 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 to more than 1/4 rated capacity with a minimum of 200 lbs.
E. Powder driven fasteners shall not be allowed for piping larger than 2", or for equipment. When used they shall not be loaded more than 1/8 rated capacity with a minimum of 200 lbs.
F. All hangers, miscellaneous steel, braces, and supports shall be galvanized, cadmium plated, or painted with corrosion resistant primer and finish coat of epoxy enamel.
G. Piping shall be supported from adjustable clevis type hangers with insulation pipe saddles at not more than 8 foot centers up to 1 1/4" dia. and 10 foot centers above 1 1/4" dia. Piping shall not support other piping.
H. Support vertical piping at floor levels. Piping shall have split rings.
I. Provide and install lintels where required for mechanical work and not indicated on architectural or structural drawings.
J. Furnish steel framing for roof openings and floor openings. Submit details for review.

3.04 SLEEVES

A. All piping passing through floors or walls shall have sleeves unless holes are cored. Sleeves shall be 16 gage galvanized steel in non-bearing walls, 10 gage galvanized steel for bearing walls, and schedule 40 galvanized pipe in floors. Sleeves shall accommodate insulation. This shall not apply to sprinkler piping.
B. Sleeves passing through foundation walls not exposed to interior spaces or sleeves passing through slab on grade may be schedule 40 PVC.
C. Wall sleeves shall finish flush with wall.
D. Floor sleeves shall extend 1 inch above floor.
E. Sleeves in walls between interior spaces and unexcavated, exterior, crawl, or backfilled spaces shall be made watertight with "Link-Seal" modular wall and casing seal. Casing shall be schedule 40 galvanized pipe with anchor flange.

3.05 PLATES

A. Furnish and install chrome plated plates wherever piping passes into finished areas.
B. Plates shall be securely fastened to piping or building construction.
C. Floor plates shall cover one inch floor extension.

3.06 OFFSETS, TRANSITIONS, MODIFICATIONS

A. Furnish and install all offsets necessary to install the work and to provide clearance for the other trades.
B. Maintain adequate headroom and clearance as directed by the A/E.
C. Ductwork transitions necessary to accommodate available space or clearance requirements shall be contract requirements.
D. Incidental modifications necessary to the installation of the systems shall be made as necessary and at the direction of the A/E.
E. Rises and drops of piping systems shall be provided as required and where directed to allow for clearances to other construction. Drains shall be installed at no additional cost to the owner. The contractor shall allow for such occurrences in his bid.
F. Piping and equipment shall be so arranged as to not pass in front of windows, doors, access panels, access doors, coil removal or filter removal space or service clearance areas. Do

not install within 3'-0" clearance of electrical panel fronts.

3.07 RECESSES

A. Furnish information to the general contractor as to sizes and locations of recesses required to install panels, boxes, grilles, and other equipment or devices which are to be recessed into walls.
B. Make offsets or modifications as required to suit final locations.

3.08 LABELING

A. All equipment shall be provided with permanent black laminated white core labels with 3/8" letters.

3.09 ACCESS

A. Locate all equipment, valves, devices, and controllers which may need service in accessible places.
B. Where access is not available; access panels shall be provided. Furnish prime painted steel access doors to the General Contractor for installation.
C. Access doors shall be 16 gauge frames and 22 gauge steel door. Access doors in fire rated walls shall have a "B" label for 1 ½ hours.
D. Maintain clearances for tube removal, coil pulls, and filter removal.

3.10 UTILITIES

A. Do not interrupt any utility or service without adequate previous notice and scheduling with the owner.
B. Refer to Division 1 for requirements for providing temporary utilities.

3.11 CUTTING AND PATCHING EXTERIOR SERVICES

A. This contractor shall be responsible for returning disturbed areas to original condition where excavation for utilities has been required.
B. Cut and patch paved areas to match original surfaces.
C. Properly tamp backfill before finishing surfaces.
D. Concrete pavements and curbs shall be formed and poured to match adjacent areas.
E. Grass areas shall be sodded and maintained until established growth is achieved.

3.12 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. Material and labor for first year warranty is to be provided.
B. Guarantee shall be extended for all non-operational periods due to failure within the guarantee period.
C. Compressor system components shall be provided with a 5 year factory warranty. Material only for years 2 through 5 is required.

3.13 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver material and equipment in manufacturer's original cartons or on skids.
B. Store material in dry enclosures or under protective coverings out of way of work progress.
C. Handle so as to prevent damage to product or any surrounding material.

3.14 MANUFACTURERS' NAMES

A. Manufacturers' names are included herein to establish those suppliers who may provide products for this project subject to the requirements of the specifications. Although a manufacturer's name may appear as an acceptable supplier it is not understood that a standard product is acceptable. Products must also meet the technical, performance, and physical requirements of the project as well as being named in the specification. Any deviations from this must be acknowledged at bid time by the supplier and he shall be solely responsible for any and all costs associated with the application of his product in the project.
B. A design cannot be prepared which accommodates the installation of all suppliers and is not intended to do so. If certain modifications must be made to accommodate one particular supplier's equipment it shall be considered the contractor's responsibility to arrange for such accommodations and be financially responsible for same.

3.15 AS-BUILT DRAWINGS

A. At the completion of the work the contractor shall furnish a reproducible as-built drawings to the A/E for approval. The drawings shall indicate all work installed and its actual size and location. If acceptable, the A/E will submit the as-built drawings to the owner as record drawings. If not acceptable, the A/E will return the drawing to the contractor to make corrections as required. The contractor will resubmit for approval.
B. The as-built drawings shall indicate measured dimensions of underground lines and other concealed work.
C. To aid in the preparation of as-built drawings, the engineer can provide the electronic files for use by the contractor. The electronic files will be provided upon execution of the engineer's electronic file release contract prepared specifically for this project. The electronic files will be released in the format used by the architect and engineer to design the project. If this file format is not compatible with the contractor's needs, additional charges for providing the changes to the requested file format may be necessary at $150/hr. billable to the contractor.

3.16 PENETRATION SEALING

A. All penetrations of Natatorium walls, fire walls, smoke walls, and floors by pipes or wiring shall be sealed to prevent the flow of gasses or smoke.
B. The sealant shall be foamed in place between the penetrant and the adjacent floor or wall with DOW Corning RTV foam or equivalent by 3M, Hilti, or Chase foam.
C. The installation shall meet the approval of the authority having jurisdiction.
D. Penetrations through rated surfaces shall have a UL rating equivalent to the adjacent surfaces.

3.17 INVERTS AND ELEVATIONS

A. Indicated inverts and elevations of existing utilities are approximate and based on the best information available.
B. Upon of award of contract, contractor shall verify in the field all such information and report

any discrepancies before proceeding with work. Contractor shall be responsible for extra work caused by his failure to verify inverts and elevations.

3.18 CONNECTIONS TO EQUIPMENT FURNISHED BY OTHERS

A. Furnish and install final connections to equipment furnished in other parts of the specification or furnished by the owner. Provide drainage connections, vent connections, water connections, fuel gas connections, gas connections to the fixtures or equipment. Plumbing connections shall include valved supplies and trapped waste connections.

3.19 CONNECTIONS TO EXISTING SYSTEMS

A. The contractor shall be responsible for connecting new systems to existing systems.
B. Arrange for outages with the owner.
C. Provide new valves at connections to existing systems.
D. Contractor shall place existing systems back into operation.
E. Contractor shall repair and replace any insulation damaged or removed during connection procedures.

3.20 COORDINATION DRAWINGS

A. Provide 3/8" = 1'-0" scale drawings showing all coordinated ductwork, piping, conduit, and equipment of all trades.
B. The sheet metal shop drawings may be used as the basis of these drawings.
C. Show ductwork, walls, beams, steel, drainage piping, domestic water piping, HVAC piping, sprinkler piping, light fixtures, electrical conduit, and equipment.
D. Contact other disciplines and obtain information to identify fully coordinated systems.
E. Submit for review and approval to the A/E.
F. Provide all dimensional data and necessary clearances to other trades for installation of fixtures and equipment within casework and counter tops.
G. Work shall not proceed until coordination is completed and all conflicts, issues, sequences etc., are resolved.

H. Unit shall be operated to determine acoustic acceptability.

3.21 WELDING

A. All electric power for arc welding shall be supplied by the contractor performing the work.

3.22 VEHICLES

A. Vehicle access to the site will be as directed by the owner.

3.23 RUBBISH DISPOSAL

A. Burning of debris on the site shall not be permitted. All debris, refuse, and waste shall be removed from the premises at regular intervals. No accumulation shall be permitted.

3.24 PROTECTION

A. Maintain all public walks and access ways.
B. Erect and maintain barricades, warning signs, and other protective means as may be directed by the owner for protection of all persons and property from injury or damage.

3.25 SCAFFOLDING

A. The contractor shall at his own expense, install, operate, protect, and maintain temporary services such as scaffolding, material hoists, access walks, etc., as may be required.

3.26 UTILITIES (Applies only to existing facilities)

A. The contractor may use the existing water and electric power for temporary construction needs.
B. The owner will direct where these services may be tapped.
C. Those services that are used during construction, but are to remain, shall be refurbished to as new condition before turning back to the owner.

3.27 CLEANUP

A. Remove all visible temporary tags or labels as well as any protective coverings and wrappings from fixtures and equipment.
B. Remove all spots, stains, soil, paint, spackle, and other foreign matter from all finished work.
C. Clean and polish all plumbing fixtures.
D. Remove all trash and debris from the premises.

3.28 MOUNTING HEIGHTS

A. Contractor to coordinate all mounting heights with all trades and architect prior to rough-in.

3.29 WORK COMPLETION

A. The contractor shall promptly correct work rejected by the engineer failing to conform to the requirements of the contract documents, whether discovered before or after substantial completion and whether or not fabricated, installed or completed. Costs of correcting such rejected work, including additional testing and inspections and compensation for the engineer's services and expenses made necessary thereby, shall be at the contractor's expense.

3.30 REQUEST FOR INFORMATION (RFI) REQUIREMENTS

A. All RFI's shall include the following information based on AIA Document G716:
   1 To, From, Project Name, Issue Date, RFI number in sequential order with all other trades, Requested Reply Date.
   2 Provide a description with specification and/or drawing references.
   3 Provide the senders recommendation including cost and/or schedule considerations.
   4 Provide receiver's reply space.
   5 Note an RFI reply is not an authorization to proceed with the work involving additional cost/time.

3.31 SHOP DRAWING REQUIREMENTS

A. The following is a list of required shop drawings for the project. Not all items may be identified, and it is the responsibility of the contractor to submit additional shop drawings where indicated in the specifications.

PLUMBING	**DATE REC'D**	**ACTION**	**DATE REC'D**	**ACTION**
COORDINATION DRAWINGS				
VALVES				
PIPING/FITTINGS/LABELING				
FIXTURES/TRIM/CARRIERS				
GAS PRESSURE REGULATORS				
AS-BUILT DRAWINGS/CAD DISK				
WARRANTIES AND GUARANTEES				
OPERATIONS AND MAINTENANCE MANUALS				
INSTRUCTIONS				
TESTS/CERTIFICATIONS				
EMERGENCY AND MANUFACTURER CONTACTS				

END OF SECTION

SECTION 22 17 00 - GAS PIPING SYSTEMS

PART 1 - GENERAL

1.01 REFERENCE

A. Refer to section 22 05 00 for requirements which are applicable to this section.
B. Refer to International Mechanical Code.
C. Refer to requirements of the local gas company.
D. Refer to NFPA Pamphlet No. 54.
E. Where the contract documents are more stringent but not in conflict with the applicable codes, the more stringent requirement shall be followed.
F. Refer to International Fuel Gas Code

1.02 WORK INCLUDED

A. Provide all labor, material, equipment, and supervision necessary to install a complete natural gas piping system with all devices, appurtenances, and accessories to complete the work.
B. Provide gas cocks on each side of gas meter and pressure regulator. Install gas meter, pressure regulator, and relief valve in accordance with the requirements of the gas company.
C. Extend service from termination point of the gas company to the building.
D. Provide gas cocks on all branch lines to equipment and appliances to allow for servicing.
E. Provide separate gas pressure regulators on each piece of equipment and appliance to regulate line pressure down to appliance/equipment usage pressure.
F. Arrange for service and meter installation with utility supplier.
G. Contractor shall paint all exterior piping exposed to the outdoors with one coat of primer and two coats of enamel paint. Finish to be selected by architect, and/or as required by the utility company.
H. Furnish and install gas booster system, piping, appurtenances, and controls. Gas booster system installation to be in accordance with PGW requirements.

1.03 MATERIAL REQUIREMENTS

A. Steel pipe schedule 40: ASTM A53 and A106, Interior piping.
B. Plastic pipe schedule 40: ASTM D2513 and D2517, Exterior underground piping.
C. Corrugated stainless steel tubing and fittings when approved by Gas Company.

1.04 PRESSURE REQUIREMENTS

A. Service pressure from main to meter/regulator:
High pressure from Gas Company.
B. Pressure Regulator:
High Pressure to #/square inches or inches water column.
C. Relief Valve:
To relieve full connected load + 25% at a pressure of psig.

PART 2 - PRODUCTS

2.01 VALVES

A. Valves 2 inch and smaller shall be conventional port, three piece body, blow-out proof stem, chrome ball and Teflon seals, 600 PSI rated and UL listed. Model # T-595-Y-UL as manufactured by NIBCO.
B. Valves over 2 inch shall be Figure 143 with flanged ends as manufactured by Rockwell-Nordstrom.

2.02 ISOLATION FITTINGS

A. Insulated dielectric unions to prevent the flow of electricity between adjacent sections of piping. Unions shall have the same pressure and temperature ratings of the installed systems.
B. Fittings shall be screwed union type up to 2 inch and flanged type above 2 inch. Flanged type shall have isolating gaskets and isolated bolt holes.
C. Manufacturer; Epco Sales Inc., Central Plastics. UL listed for gas piping service.

2.03 UNIONS

A. All equipment, control valves, and regulators shall be provided with union connections up to 2 inch and flanged connections above 2 inch.
B. Unions and flanges shall have pressure and temperature ratings equivalent to the fittings in the adjacent piping system. Screwed unions shall be bronze to bronze seat.
C. Unions shall be placed between the appliance and its shutoff valve.

2.04 SCREWED PIPE FITTINGS

A. Pipe joints made on screwed pipe shall be sealed with Teflon ribbon wrapped on the threads before assembly.
B. Usage shall be in conformance with the manufacturer’s instructions.

2.05 PRESSURE REGULATOR - SERVICE

A. In accordance with utility company requirements.

2.06 PRESSURE REGULATOR - EQUIPMENT/APPLIANCES

A. Individual appliance gas pressure regulators shall be provided for each individual appliance to reduce pressure from line pressure to appliance pressure.
B. Pressure regulators shall be UL listed for gas service.
C. Pressure regulators shall be accessible and protected from physical damage.
D. Exterior regulators shall be approved for outdoor applications.
E. The vent from vented regulators shall be extended to the exterior of the building. Vents shall not terminate near windows or door openings, air intakes, areaways or other confined areas

where gas may accumulate or cause gas to re-enter building spaces.

2.07 RELIEF VALVE

A. Install on the low pressure side of each pressure regulator.
B. Relieve to exterior atmosphere.

PART 3 - EXECUTION

3.01 PIPING SYSTEMS

A. Branch connections shall be made to the top of horizontal lines. All piping shall be arranged to drain to a drainable low point. The low point shall be provided with a nipple and cap for the removal of moisture.
B. Piping shall run square with building lines.
C. Necessary drains, offsets, rises, vents, and drips shall be provided for as part of the contracted work. Where any such rise or drip is necessary the contractor shall install same as part of the work and as directed by the engineer. The drawings are diagrammatic in nature and due to the small scale, it is not possible to show all necessary drains, vents, offsets and rises which may be required to properly execute the work and such items shall be provided as needed. Drips shall be accessible.
D. Running or close nipples are not allowed.
E. Furnish and install dielectric pipe couplings between sections of ferrous and nonferrous piping systems and between copper or brass equipment and ferrous piping systems.
F. Steel piping shall be supported from adjustable clevis type piping up to 1". Over 1" to be on 10'-0" centers. Refer to manufacturer for piping other than steel.
G. Piping above roof shall be cleaned, primed, and provided with 2 coats of epoxy enamel.

H. Furnish and install an appliance pressure regulator on all equipment unless otherwise indicated.
I. Piping shall not be installed underground beneath buildings.
J. Piping shall be capped immediately after installation.
K. Valves shall not be concealed above ceilings.

3.02 PIPING IDENTIFICATION

A. Provide stencils or snap-on labels to identify gas piping systems.
B. Labels shall indicate "GAS" and the direction of flow.
C. Labels shall be required where piping enters and leaves mechanical rooms, at inlets and outlets of equipment, at 50 foot intervals where exposed.

3.03 WELDING

A. All concealed black steel piping shall be fusion welded.
B. Welding shall be performed in conformance with the ASME Boiler and Pressure Vessel Code Section IX.
C. Elbows, tees, and branch connections shall be made with welding fittings ANSI B16.9.

D. Furnish welder test certificates for review. Certificates of successful welder qualification by the following organizations shall be acceptable;
   ASME Boiler and Pressure Vessel Code
   ANSI Code for Pressure Piping
   National Certified Pipe Welding Bureau
   Military Specification MIL-STD-248.

E. Weld-o-lets and Thread-o-lets are allowed but shall be a maximum of one size smaller than line size, i.e., a maximum of a 3 inch weld-o-let on a 4 inch pipe.

3.04 VALVES

A. Valves shall be installed with their stems above the horizontal.
B. Valves shall be installed on the connections to all equipment and control valves to allow for isolation for repair.
C. Valves shall not be installed above ceilings.
D. An emergency shut off valve to shut off the entire system shall be provided, accessible from outside the building.
E. Minimum depth of bury: 18".
F. Connections between plastic and steel piping shall only be made outside, underground, with approved fittings.
G. Piping through foundation walls shall be encased in an approved vented sleeve. The annular space shall be sealed to prevent the leakage of gas into the structure.
H. TESTING
I. The gas system shall be tested in accordance with the local gas company and NFPA Pamphlet No. 54.
J. Provide a report of the test procedure utilized indicating test pressure and duration, date, and signatures of witnesses which shall include the owner, Gas Company official, and representative of the A/E.
K. Sections of piping which will be concealed shall be tested prior to concealment.
L. Test pressure shall be 1.5 times the system working pressure but not less than 3 psi. There shall be no loss in pressure for a ten minute period. Repair any leaks and retest.

END OF SECTION

DIVISION 23 - HVAC

SECTION 23 05 00 - STANDARD CONDITIONS FOR HVAC

PART 1 - GENERAL

1.01 REFERENCE

A. Requirements established within the portions of this project manual titled Division 1, General Requirements are collectively applicable to the work of this section.
B. Instructions to Bidders, Special Conditions and addenda as issued are part of this specification.
C. Mechanical, Plumbing, and HVAC drawings along with all other project drawings and specifications represent the work of this section.
D. Drawings, Contract, General Conditions and Supplementary Conditions form a part of this section, by reference thereto and shall have the same force and effect as if printed herewith in full. Failure to review these sections shall not relieve the Contractor of his responsibility to fully comply with the terms therein.

1.02 SCOPE

A. Provide labor, material, equipment, and supervision necessary to install complete operating mechanical systems as indicated on the drawings and specified herein, including all work at the site and within the proposed construction areas to accomplish the required work.
B. It shall be the contractor’s responsibility to coordinate his work and the work of his subcontractors to ensure that all the work is covered. He shall designate who is responsible for various portions of work which may overlap so that there is complete coverage of all required work. It is the position of the owner and the A/E that all work is the responsibility of the mechanical contractor within this Division of the work.
C. Contractor shall provide all demolition necessary to remove and replace, repair, install new or modify existing work whether it be walls, floors, ceilings, structure, mechanical or electrical required to install his work. Contractor shall replace all work to leave in a finished condition.
D. All work shown on the drawings and not expressly mentioned in the specifications and all work specified but not shown on the drawings, but necessary for the proper execution of same shall be performed by the contractor. It is not the intent of the drawings and specifications to describe every feature and detail of the work.
E. No additions to the contract amount will be approved for any materials, equipment, or labor to perform additional work unless it can be clearly shown to be beyond the scope and intent of the drawings and specifications.
F. HVAC contractor's scope of work shall include but not be limited to the following:
    1. Air distribution system, associated ductwork, devices, equipment, and insulation.
    2. Packaged air handling unit system with natural gas heating.
    3. Ductless Split system heat pump. Cassette type. (For Toby Farms)
    4. Condensate drainage system (air conditioner units). Condensate pumps.
    5. Roof and wall penetrations for mechanical work and all associated roof work.

6. Demolition of existing work for new work.
7. Test Balance & Adjust.
8. Repair existing areas affected by the new construction. Patch, repair and finish to match existing.
9. Automatic Temperature Control System.
10. All other work identified in Division 23 and/or on the mechanical drawings except that identified as plumbing or fire protection work.
11. Contractor shall not utilize new HVAC equipment for temporary heating, cooling, and dehumidification purposes. Temporary HVAC is to be provided as described under the architect's general conditions. Contractor is to protect all HVAC equipment during construction and cover all ductwork openings.
12. Fire stopping of penetrations. (See Section 23 05 50)

1.03 REGULATIONS, CODES, AND STANDARDS

A. Work shall be performed in accordance with the latest adopted codes, amendments, regulations, and ordinances of the authorities having jurisdiction. Observe all safety regulations including the requirements of OSHA.
B. Obtain and pay for all permits, connection charges, inspections, and certificates required to complete the work.
C. Latest editions of any referenced standards shall govern.
D. Contractor shall arrange and pay for all tests and inspections specified herein or required by above agencies and furnish required certificate of inspection to owner.
E. Where the contract documents are more stringent but not in conflict with the applicable codes, the more stringent requirements shall be followed.

1.04 SUBMISSIONS

A. The procedure for submissions of shop drawings shall be as specified in Division 1, or as a minimum, as indicated below.
B. Furnish submissions of shop drawings and samples of materials and equipment as indicated in these sections, on the drawings, or as directed by the A\E. Submissions will be made in a timely fashion such that adequate time exists to review the drawings, or material, and arrive at the site in accordance with the project schedule.
C. Submissions will not be accepted with work defined as "By Others". Identify contractor by name and with his approval so indicated. Submissions are required prior to purchasing, fabrication, or installation of any material or equipment. Submissions shall be reviewed and certified by the submitting contractor that they are in accordance with the project documents.
D. When requested by the engineer, shop drawings shall be required to be submitted to designated agencies for review and approval prior to submission to the engineer.
E. Contractor shall arrange and pay for all tests and inspections specified herein or required by above agencies and furnish required certificate of inspection to owner.
F. Contractor to forward a copy of submittals which have electrical requirements to the Electrical Contractor (EC) for coordination of voltage, amperage, and phase. Response to be received from EC prior to ordering of equipment by mechanical contractor.
G. Submissions shall include warrantees by the manufacturer for equipment being provided. Submissions for commonly related items such as fixtures, trim, carriers, drains shall be combined in a single brochure with all items being furnished clearly identified.
H. Shop drawings and submittals shall be checked and stamped by the contractor before submitting. They shall conform to measurements made at the site, the contract requirements,

and coordinated with all other trades.

I. Specific models in catalog sheets must be identified as well as all options, voltages, phases, etc. identified so as to be clear on what is being provided.

J. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.

K. To aid in the preparation of submittals or shop drawings, the engineer can provide the electronic files for use by the contractor. The electronic files will be provided upon execution of the engineer's electronic file release contract prepared specifically for this project. The electronic files will be released in the format used by the architect and engineer to design the project. If this file format is not compatible with the contractor's needs, additional charges for providing the changes to the requested file format may be necessary at $150/hr. billable to the contractor.

L. Model numbers – It is the contractor's responsibility to confirm the latest model numbers at the time of bid. The model number indicated on the drawings are for reference. No additional costs will be accepted if the manufacturer has updated the model number during or after the design process thru to the point of shop drawing issuance. The performance and capacity indicated in the schedules on the drawings take precedent over the model number.

1.05 SITE INSPECTION

A. Visit site, inspect, and become aware of all conditions which may affect the work. Investigate utilities, protection requirements for adjacent facilities, storage locations, and access to the construction area.

B. Submission of bid will be deemed evidence of having complied with this request. Contractor may not request additional costs for existing conditions which were evident from inspection of the site.

1.06 SUBSTITUTIONS

A. Material and equipment specified shall be deemed as that which the bidder's quotation represents.

B. Once bids are accepted only that material and equipment listed in the specifications or added by addenda shall be acceptable. Substitution information for inclusion in an addenda must be received by the A\E at least 10 days prior to bid opening. If acceptable, an addenda will be issued which will add the additional acceptable manufacturers or materials and be available for all contractors to consider. It shall be a basic premise that a contractor is a lowest bidder because he utilized substituted materials or equipment as opposed to specified materials or equipment.

C. If the contractor submits alternate equipment, manufacturers, systems, methods, or materials, not specifically identified in the specifications, additional review and investigation time may be required by the engineer. If the engineer determines additional review time is required because of the substitution, then this will be a billable service by the engineer at the rate of $150.00/hr. for such services. Also billable will be any redesign time and revisions to drawings should they be necessary for incorporation into the work. Services will be billable

to the contractor making such substitutions and will be payable prior to approval or rejection.

D. If the contractor elects to submit alternate equipment, manufacturers, systems, methods, or materials, not specifically identified in the drawings and specifications, it is the contractor's responsibility to coordinate the work with other trades and pay for any associated costs with the substitution or change.

E. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.

1.07 DRAWINGS AND SPECIFICATIONS

A. The drawings are generally diagrammatic and necessary field coordination and adjustment must be provided by the contractor prior to installation. Such deviations to the work to allow for coordination shall be kept to a minimum and any such deviations shall be at no extra cost.

B. When a conflict or contradiction exists either between drawings and specs or between specs or between different drawings or details, the more stringent shall apply.

C. Drawings and specifications are intended to be taken as a whole and each is to supplement the other. It is not intended that all work must be both shown on drawings and specified in the specifications.

D. An item shown on the drawings and not indicated in the specifications is to be understood to be required for the project. An item specified and not shown on the drawings is to be understood to be required for the project.

E. The architects or engineer's interpretation of the documents shall be binding upon the contractor. If a question arises, the contractor shall ask for an interpretation prior to bidding and an answer shall be issued as an addendum to all bidders.

F. If a question arises after bidding the A/E interpretation shall govern.

1.08 MEASUREMENTS

A. Before ordering materials or commencing with any work, the contractor shall verify all measurements at the building. Coordination of equipment, materials, spaces, and dimensions are the responsibility of the contractor.

1.09 PROGRESS SCHEDULE

A. Provide a project schedule which shall show start, sequence of each type of work, milestone schedule, and completion of each type of work, with overall completion date.

1.10 COST SCHEDULE

A. Provide a detailed cost breakdown indicating labor and material amounts for various types of work.

B. AIA forms are required for this submission.

1.11 COMPLETION

A. The contractor shall deliver to the owner, with his request for final payment, copies of all manufacturer's guarantees, equipment instructional manuals, a complete set of all final shop drawings, catalog cuts, service contracts, and other items as may be required elsewhere in the documents.

1.12 OFFICE

A. The contractor shall set up his job office (desk) where directed by the owner.

1.13 STORAGE

A. Material shall be stored only where directed by the owner.

1.14 SANITARY

A. The contractor will at his own expense, provide and maintain in a sanitary condition, a portable chemical toilet.
B. Toilet will be located where directed by the owner.

PART 2 - PRODUCTS

2.01 GENERAL

A. All material shall be new and of present day manufacturer.
B. All material and equipment shall be in conformance with accepted trade standards.
C. 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 may be necessary to complete the installation.
D. The word “provide” means “furnish and install complete, tested, and adjusted as necessary with all accessories, covers, escutcheons”. The word “piping” means pipe, fitting, controls, valves, and hangers as required for a complete system.

2.02 MOTORS

A. Incorporate latest IEEE and NEMA standards.
B. All copper windings with ball bearings.
C. Indoors; drip proof, 40 degree C rise.
D. Outdoors; totally enclosed 55 degree C rise.
E. Motors over 10 HP to be high efficiency with PF in excess of 0.9.

2.03 MOTOR STARTERS AND CONTACTORS

A. Fractional with horsepower up to ½ HP; electrical contract.
B. Polyphase and single phase above ½ HP: this contract.
C. Electrical contractor shall install all starters except for those provided as an integral part of equipment.

D. Polyphase starters shall be magnetic combination type, across-the-line electrically operated, electrically held, three pole assemblies, with arc extinguishing characteristics, silver to silver renewable contacts, 3 pole thermal bi-metallic, red run pilot light, individual phase protection, with overload heaters matched to motors installed and with 4 auxiliary contact, Hand-off-Auto switch, and control transformer.
E. For single phase motors above ½ HP provide magnetic combination single phase motor starters with overloads, non-fusible disconnect switch, red run pilot light, integral 120 volt control transformer with dual primary fusing auxiliary contacts.
F. Starters shall be as manufactured by G. E., Siemens, Square "D", Cerus or Cutler-Hammer.

2.04 EQUIPMENT START UP

A. Verify that equipment is operating within warranty requirements.
B. Advise owner and A/E at least two days prior.
C. Verify proper operation. Obtain signed statement by manufacturer or his representative that equipment is operating within warranty requirements. Submit statement to A/E.

2.05 LUBRICATION

A. Lubricate all equipment in accordance with manufacturer’s instructions.
B. Lubricate prior to start up.
C. Provide one year’s supply of lubricants to the owner.

2.06 OPERATING INSTRUCTIONS AND MANUALS

A. Properly and fully instruct owner’s personnel in the operation and maintenance of all systems and equipment.
B. Ensure 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. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalogue cuts, wiring diagrams, control sequences, service requirements, piping diagrams, names, and addresses of vendors, suppliers, and emergency contacts. Three manuals shall be provided.
E. Provide to the owner any special tools necessary to operate any of the equipment.

2.07 DRAIN PANS

A. Provide auxiliary galvanized steel condensate drain pan with 1" MPT drain connection for all interior fan coil units, cooling coils, heat pumps, and any other cooling equipment requiring condensate removal. Drain to suitable discharge point acceptable to owner and A/E. Drain lines shall be separate and independent of A/C unit drain system unless provided with interlocked water sensing switch.
B. All water heaters mounted above the floor shall be provided with drain pans. Drain to suitable discharge point acceptable to owner and A/E. To be visible outfall.
C. Drains shall slope down in the direction of flow at 1inch per 8 feet.

PART 3 - EXECUTION

3.01 PROTECTION

A. Cover duct openings during construction.
B. Plug or cap open ends of piping systems and conduit.
C. Stored materials shall be covered to prevent damage by inclement weather, sun, dust, or moisture.
D. Protect all installed work until accepted in place by the owner. Cover plumbing fixtures and lighting fixtures.
E. Do not install plates, polished metal escutcheons, thermostats, and other finished devices until masonry, tile, and painting operations are complete or protect otherwise.
F. Protect all existing or new work from operations which may cause damage such as hauling, welding, soldering, painting, insulating, and covering.

3.02 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.

3.03 EXCAVATION, SHORING, PUMPING, BACKFILLING

A. Perform all excavation required to install the work. Deposit excavated material so as not to create a slide hazard.
B. No work shall be placed on rock. Cushion with 6 " layer of crushed stone.
C. Protect tree roots with burlap covering and maintain moist until backfilled.
D. Base estimates on excavation which will include earth, sand, clay, rubbish, debris, and all other materials up to one cubic yard in size. Boulders or rock larger than one cubic yard which need to be broken up with pneumatic equipment or explosives will be separately negotiated at the time of discovery with the owner and A/E. Do not proceed with rock excavation until an agreement is reached.
E. Maintain excavations free of water.
F. Shore excavations to prevent cave-in in accordance with OSHA regulations and to prevent strains on work put in place until ready to receive backfill.
G. Backfill with clean material and pneumatically tamp in 8" layers. Remove excess material, including rock, from site or as directed by the A/E.
H. Backfill piping trenches within 18" of footings, columns, piers, or grade beams, with concrete. Protect piping from direct contact and adherence to concrete.
I. Return to original condition any areas disturbed for excavation.

3.04 FASTENERS, HANGERS, AND SUPPORTS

A. Furnish and install all hangers and supports required to suspend, mount, or hang the work.
B. Furnish and install all miscellaneous steel angles, channels, beams, clips, brackets, and anchors 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 to more than 1/4 rated capacity with a minimum of 200 lbs.
E. Powder driven fasteners shall not be allowed for piping larger than 2", or for equipment. When used they shall not be loaded more than 1/8 rated capacity with a minimum of 200 lbs.
F. All hangers, miscellaneous steel, braces, and supports shall be galvanized, cadmium plated, or painted with corrosion resistant primer and finish coat of epoxy enamel.
G. Piping shall be supported from adjustable clevis type hangers with insulation pipe saddles as indicated in the piping system specification sections. Piping shall not support other piping.
H. Support vertical piping and ductwork at floor levels. Piping shall have split rings. Ductwork shall have 1 1/2" angle iron frames.
I. Provide and install lintels where required for mechanical work and not indicated on architectural or structural drawings.
J. Furnish steel framing for roof openings and floor openings. Submit details for review.

3.05 SLEEVES

A. All piping passing through floors or walls shall have sleeves unless holes are cored. Sleeves shall be 16 gage galvanized steel in non-bearing walls, 10 gage galvanized steel for bearing walls, and schedule 40 galvanized pipe in floors. Sleeves shall accommodate insulation. This shall not apply to sprinkler piping.
B. Sleeves passing through foundation walls not exposed to interior spaces or sleeves passing through slab on grade may be schedule 40 PVC.
C. Wall sleeves shall finish flush with wall.
D. Floor sleeves shall extend 1 inch above floor.
E. Sleeves in walls between interior spaces and unexcavated, exterior, crawl, or backfilled spaces shall be made watertight with "Link-Seal" modular wall and casing seal. Casing shall be schedule 40 galvanized pipe with anchor flange.

3.06 PLATES

A. Furnish and install chrome plated plates wherever piping passes into finished areas.
B. Plates shall be securely fastened to piping or building construction.
C. Floor plates shall cover one inch floor extension.

3.07 OFFSETS, TRANSITIONS, MODIFICATIONS

A. Furnish and install all offsets necessary to install the work and to provide clearance for the other trades.
B. Maintain adequate headroom and clearance as directed by the A/E.
C. Ductwork transitions necessary to accommodate available space or clearance requirements shall be contract requirements.
D. Incidental modifications necessary to the installation of the systems shall be made as necessary and at the direction of the A/E.
E. Rises and drops of piping systems shall be provided as required and where directed to allow for clearances to other construction. Drains shall be installed at no additional cost to the owner. The contractor shall allow for such occurrences in his bid.
F. Ductwork, piping, conduit, and equipment shall be so arranged as to not pass in front of windows, doors, access panels, access doors, coil removal or filter removal space or service clearance areas. Do not install within 3'-0" clearance of electrical panel fronts.

3.08 RECESSES

A. Furnish information to the general contractor as to sizes and locations of recesses required to install panels, boxes, grilles, and other equipment or devices which are to be recessed into walls.
B. Make offsets or modifications as required to suit final locations.

3.09 EQUIPMENT SETTING

A. Furnish and install as a minimum, a 4" thick concrete pad beneath all floor mounted equipment in mechanical rooms, boiler rooms, or equipment rooms, or outside on grade. This shall not apply to residential installations of water heaters and air handling units or furnaces unless detailed on drawings or specified elsewhere.
B. Furnish and install as a minimum, spring vibration isolators under any equipment 5 HP and over and rubber-in-shear vibration isolation under all equipment less than 5 HP. This shall apply to residential installations.
C. Reinforce concrete with No. 4 rods 12" on centers both ways.
D. Pad to have 3/4" dowels into concrete at 1 per 4 square feet.

3.10 LABELING

A. All equipment, panels, controls, safety switches, and devices shall be provided with permanent black laminated white core labels with 3/8" letters.
B. This shall also apply to all controllers, remote start/stop push buttons, equipment cabinets, and where directed by the A/E.
C. This shall not apply to local room thermostats and light switches.

3.11 FLASHING AND COUNTERFLASHING

A. Piping and conduit through the roof shall be flashed by the General Contractor. This contractor shall furnish counterflashing.
B. Ductwork through the roof and roof mounted duct connected equipment shall be provided with prefabricated roof curbs. General contractor shall flash. This contractor shall counterflash.
C. Structural dunnage for roof mounted equipment shall be flashed and counterflashed. Prefabricated roof curbs may be utilized.

3.12 ACCESS

A. Locate all equipment, valves, devices, and controllers which may need service in accessible places.
B. Where access is not available; access panels shall be provided. Furnish prime painted steel access doors to the General Contractor for installation.
C. Access doors shall be 16 gauge frames and 22 gauge steel door. Access doors in fire rated walls shall have a "B" label for 1 ½ hours.
D. Maintain clearances for tube removal, coil pulls, and filter removal.

3.13 WIRING

A. Power wiring shall be provided by the Division 26 Electrical Contractor. This contractor shall furnish all 3 phase starters, pushbuttons, and controllers necessary to operate the

equipment. The Electrical Contractor shall store and install the electrical devices and furnish and install the power wiring.

B. Control wiring shall be furnished and installed under Division 23 portion of the work. Wiring for controls is control wiring whether it is line voltage or low voltage.
C. All wiring shall be in accordance with the NEC.
D. Pushbuttons shall be maintain-contact type.
E. Refer to the electrical specifications for wiring methods.
F. Plenum rated cable is required for control wiring.

3.14 UTILITIES

A. Do not interrupt any utility or service without adequate previous notice and scheduling with the owner.
B. Refer to Division 1 for requirements for providing temporary utilities.

3.15 CUTTING AND PATCHING EXTERIOR SERVICES

A. This contractor shall be responsible for returning disturbed areas to original condition where excavation for utilities has been required.
B. Cut and patch paved areas to match original surfaces.
C. Properly tamp backfill before finishing surfaces.
D. Concrete pavements and curbs shall be formed and poured to match adjacent areas.
E. Grass areas shall be sodded and maintained until established growth is achieved.

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 unless otherwise specified. Material and labor for first year warranty is to be provided.
B. Guarantee shall be extended for all non-operational periods due to failure within the guarantee period.
C. Compressors and refrigeration system components shall be provided with a 5 year factory warranty. Material only for years 2 through 5 is required.

3.17 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver material and equipment in manufacturer’s original cartons or on skids.
B. Store material in dry enclosures or under protective coverings out of way of work progress.
C. Handle so as to prevent damage to product or any surrounding material.

3.18 MANUFACTURERS’ NAMES

A. Manufacturers’ names are included herein to establish those suppliers who may provide products for this project subject to the requirements of the specifications. Although a manufacturer’s name may appear as an acceptable supplier it is not understood that a standard product is acceptable. Products must also meet the technical, performance, and physical requirements of the project as well as being named in the specification. Any deviations from this must be acknowledged at bid time by the supplier and he shall be solely responsible for any and all costs associated with the application of his product in the project.
B. A design cannot be prepared which accommodates the installation of all suppliers and is not

intended to do so. If certain modifications must be made to accommodate one particular supplier's equipment it shall be considered the contractor's responsibility to arrange for such accommodations and be financially responsible for same.

3.19 AS-BUILT DRAWINGS

A. At the completion of the work the contractor shall furnish a reproducible as-built drawings to the A/E for approval. The drawings shall indicate all work installed and its actual size and location. If acceptable, the A/E will submit the as-built drawings to the owner as record drawings. If not acceptable, the A/E will return the drawing to the contractor to make corrections as required. The contractor will resubmit for approval.
B. The as-built drawings shall indicate measured dimensions of underground lines and other concealed work.

3.20 PENETRATION SEALING

A. All penetrations of fire walls, smoke walls, and floors by ducts, pipes, conduit, or wiring shall be sealed to prevent the flow of gases or smoke.
B. The sealant shall be foamed in place between the penetrant and the adjacent floor or wall with DOW Corning RTV foam or equivalent by 3M, Hilti, or Chase foam.
C. The installation shall meet the approval of the authority having jurisdiction.
D. Penetrations through rated surfaces shall have a UL rating equivalent to the adjacent surfaces.
E. All other penetrations of walls either above ceilings or exposed shall be closely sealed around the penetration with caulking or packing to prevent flow of air or sound through the wall.

3.21 CUTTING AND PATCHING INTERIOR SURFACES

A. Respective contractor shall install all hangers, supports, pipe sleeves in floors, walls, partitions, ceilings, and roof slabs as construction progresses to permit their work to be built into place and to eliminate unnecessary cutting of construction work.
B. All cutting of concrete, or other material for the passage of piping and ductwork through floors, walls, partitions, and ceiling shall be done by the respective contractor where necessary to install his work. Respective contractor will close all such openings around piping, ductwork, and conduit with materials equivalent to that removed. All exposed surfaces shall be left in suitable condition for refinishing without further work.
C. Contractor shall patch and repair any existing openings created by the demolition work in floors, walls, partitions, and ceilings not being reused for the new construction.

3.22 INVERTS AND ELEVATIONS

A. Indicated inverts and elevations of existing utilities are approximate and based on the best information available.
B. Upon of award of contract, contractor shall verify in the field all such information and report any discrepancies before proceeding with work. Contractor shall be responsible for extra work caused by his failure to verify inverts and elevations.

3.23 CONNECTIONS TO EQUIPMENT FURNISHED BY OTHERS

A. Furnish and install final connections to equipment furnished in other parts of the specification or furnished by the owner. Provide drainage connections, vent connections, water connections, fuel gas connections, duct connections, gas connections to the fixtures or equipment. Plumbing connections shall include valved supplies and trapped waste connections.

3.24 CONNECTIONS TO EXISTING SYSTEMS

A. The contractor shall be responsible for connecting new systems to existing systems.
B. Arrange for outages with the owner.
C. Contractor shall shut down and drain existing systems.
D. Contractor shall cut in, weld, solder, or thread, and make connections compatible with existing systems.
E. Provide new valves at connections to existing systems.
F. Contractor shall refill existing and fill new systems.
G. Contractor shall purge air from systems, both new and existing.
H. Contractor shall place existing systems back into operation.
I. Contractor shall repair and replace any insulation damaged or removed during connection procedures.

3.25 WELDING

A. All electric power for arc welding shall be supplied by the contractor performing the work.

3.26 VEHICLES

A. Vehicle access to the site will be as directed by the owner.

3.27 RUBBISH DISPOSAL

A. Burning of debris on the site shall not be permitted. All debris, refuse, and waste shall be removed from the premises at regular intervals. No accumulation shall be permitted.

3.28 PROTECTION

A. Maintain all public walks and access ways.
B. Erect and maintain barricades, warning signs, and other protective means as may be directed by the owner for protection of all persons and property from injury or damage.

3.29 SCAFFOLDING

A. The contractor shall at his own expense, install, operate, protect, and maintain temporary services such as scaffolding, material hoists, access walks, etc., as may be required.

3.30 UTILITIES (Applies only to existing facilities)

A. The contractor may use the existing water and electric power for temporary construction needs.
B. The owner will direct where these services may be tapped.
C. Those services that are used during construction, but are to remain, shall be refurbished to

as new condition before turning back to the owner.

3.31 CLEANUP

A. Remove all visible temporary tags or labels as well as any protective coverings and wrappings from fixtures and equipment.
B. Remove all spots, stains, soil, paint, spackle, and other foreign matter from all finished work.
C. Clean and polish all plumbing fixtures.
D. Remove all trash and debris from the premises.

3.32 MOUNTING HEIGHTS

A. Contractor to coordinate all mounting heights with all trades and architect prior to rough-in.
B. Maximum thermostat mounting height (top of thermostat) in accordance with ADA.
   1. Side reach: 48" A.F.F.
   2. Forward reach: 48" A.F.F.

3.33 WORK COMPLETION

A. The contractor shall promptly correct work rejected by the engineer failing to conform to the requirements of the contract documents, whether discovered before or after substantial completion and whether or not fabricated, installed or completed. Costs of correcting such rejected work, including additional testing and inspections and compensation for the engineer's services and expenses made necessary thereby, shall be at the contractor's expense.

3.34 REQUEST FOR INFORMATION (RFI) REQUIREMENTS

A. All RFI's shall include the following information based on AIA Document G716:
   1. To, From, Project Name, Issue Date, RFI number in sequential order with all other trades, Requested Reply Date.
   2. Provide a description with specification and/or drawing references.
   3. Provide the senders recommendation including cost and/or schedule considerations.
   4. Provide receiver's reply space.
   5. Note an RFI reply is not an authorization to proceed with the work involving additional cost/time.

3.35 SHOP DRAWING REQUIREMENTS

A. The following is a list of required shop drawings for the project. Not all items may be identified, and it is the responsibility of the contractor to submit additional shop drawings where indicated in the specifications.

HVAC	**DATE REC'D**	**ACTION**	**DATE REC'D**	**ACTION**
VIBRATION ISOLATION				

HVAC	**DATE REC'D**	**ACTION**	**DATE REC'D**	**ACTION**
INSULATION A. Piping B. Ductwork				
SHEET METAL DRAWINGS				
SPLIT SYSTEMS				
PACKAGED UNITS				
VOLUME DAMPERS				
GRILLES, REGISTERS, DIFFUSERS				
EQUIPMENT CURBS				
AUTOMATIC TEMPERATURE CONTROL A. DEVICES B. WIRING DIAGRAMS C. SEQUENCES				
TEST, BALANCE AND ADJUST REPORT				
AS-BUILT DRAWINGS				
WARRANTIES AND GUARANTEES				
OPERATIONS AND MAINTENANCE MANUALS				
INSTRUCTIONS				
EMERGENCY AND MANUFACTURER CONTACTS				
CONDENSATE PUMPS				

END OF SECTION

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small, and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.02 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
   1. Motor controllers.
   2. Torque, speed, and horsepower requirements of the load.
   3. Ratings and characteristics of supply circuit and required control sequence.
   4. Ambient and environmental conditions of installation location.

1.03 SUBMITTALS

A. Shop drawing submittals for motorized equipment shall include, but not limited to, the following information on motors provided with equipment.
   1. Manufacturer’s name and cutsheets.
   2. Motor type.
   3. Horsepower.
   4. Voltage/Phase/Hertz.
   5. RPM.
   6. Service factor.
   7. Insulation class.
   8. NEC code number.
   9. Motor efficiency and testing method and results.

PART 2 - PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.
B. All materials and equipment furnished shall be installed as per manufacturer’s requirements and conform to the requirements of Division 26.

2.02 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg. C and at altitude of 3300 feet

above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
C. Incorporate latest IEEE and NEMA standards.
D. All copper windings with ball bearings.
E. Indoors; drip proof, 40 degree C rise.
F. Outdoors; totally enclosed 55 degree C rise.
G. Motors over 10 HP to be high efficiency with PF in excess of 0.9.

2.03 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.
B. Efficiency: Energy efficient, as defined in NEMA MG 1.
C. Service Factor: 1.15.
D. Multispeed Motors: Variable torque.
    1. For motors with 2:1 speed ratio, consequent pole, single winding.
    2. For motors with other than 2:1 speed ratio, separate winding for each speed.
E. Rotor: Random-wound, squirrel cage.
F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
G. Temperature Rise: Match insulation rating.
H. Insulation: Class F.
I. Code Letter Designation:
    1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
    2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
    1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
    2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
    3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
    4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.05 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp. shall be one of the following, to suit starting torque and requirements of specific motor application:
    1. Permanent-split capacitor.
    2. Split phase.

3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
D. Motors 1/20 HP and Smaller: Shaded-pole type.
E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.06 MOTOR STARTERS

A. Fractional with horsepower up to ½ HP; electrical contract.
B. Polyphase and single phase above ½ HP: this contract.
C. Electrical contractor shall install all starters except for those provided as an integral part of equipment.
D. Polyphase starters shall be magnetic combination type, across-the-line electrically operated, electrically held, three pole assemblies, with arc extinguishing characteristics, silver to silver renewable contacts, 3 pole thermal bi-metallic, red run pilot light, individual phase protection, with overload heaters matched to motors installed and with 4 auxiliary contact, Hand-off-Auto switch, and control transformer.
E. For single phase motors above ½ HP provide magnetic combination single phase motor starters with overloads, non-fusible disconnect switch, red run pilot light, integral 120 volt control transformer with dual primary fusing auxiliary contacts.
F. Starters shall be as manufactured by G. E., Siemens, Square "D", Cerus or Cutler-Hammer.

PART 3 - EXECUTION

3.01 GENERAL:

A. Motors shall be leveled, set in true angular and concentric alignment with driven equipment, and bolted firmly to motor base, if not mounted on equipment. Motors’s factory-mounted on equipment shall be checked for alignment to driven equipment and mounting bolts shall be checked to ensure bolts are tightly fastened.
B. Coordination: The Mechanical Contractor shall have the responsibility to provide adequate rough-in information to the Electrical Contractor. Any costs, such as patching and refinishing of walls, resulting from inadequate information shall be the responsibility of the Mechanical Contractor.
C. For variable frequency drives, refer to Specification 23 09 93.

END OF SECTION

SECTION 23 05 48.13 - VIBRATION CONTROLS FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Open-spring isolators
2. Resilient pipe guides
3. Spring hangers
4. Duct hangers
5. Equipment rail bases
6. Floating concrete bases
7. Roof curb bases

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Delegated-Design Submittal: For each vibration isolation device.
1. Include design calculations for selecting vibration isolators.

PART 2 - PRODUCTS

2.01 OPEN SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Kinetics Noise Control, Inc.
b. Mason Industries, Inc.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
7. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
8. Application: Air handling units not slab on grade. Roof mounted condensing units over 5 tons cooling capacity.

2.02 RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch-thick neoprene.
   1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.03 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Kinetics Noise Control, Inc.
      b. Mason Industries, Inc.
   2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
   3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
   7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
   8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
   9. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
   10. Application: Below 5 ton horizontal suspended heat pumps and fan/coil units, in-line exhaust fans.

2.04 DUCT HANGERS

A. Vibration hangers shall contain a steel spring located in a neoprene cup manufactured with a grommet to prevent a short circuiting of the hanger rod. The cup shall contain a steel washer designed to properly distribute the load on the neoprene and prevent its extrusion. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30 degree arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Hangers shall be provided with an eye bolt on the spring end and provision to attach the housing to the flat iron duct straps. Submittals shall include a scale drawing of the hanger showing the 30 degree capability.

B. Hangers shall be type W30 as manufactured by Mason Industries, Inc. or equivalent by Vibration Eliminator Company or Amber Booth.

C. Application: Ductwork in mechanical rooms below occupied spaces.

2.05 EQUIPMENT RAIL BASES

A. Vibration isolator manufacturer shall provide steel members welded to height saving brackets to cradle machines having legs or bases that do not require a complete supplementary rigid to prevent strains in the equipment.
B. Inverted saddles shall be type ICS as manufactured by Mason Industries, Inc. or equivalent by Vibration Eliminator Company or Amber Booth.
C. Application: Base mounted HVAC units.

2.06 FLOATING CONCRETE BASES

A. Vibration isolator manufacturer shall furnish rectangular structural beam or channel concrete forms for floating foundations. Bases for split case pumps shall be large enough to provide support for suction and discharge base ells. The base depth need not exceed 12" unless specifically recommended by the base manufacturer for mass or rigidity. In general, bases shall be a minimum of 1/12th of the longest dimension of the base, but not less than 6". Forms shall include minimum concrete reinforcement consisting of half-inch bars or angles welded in pa\lace on 6" centers running both ways in a layer 1 1/2" above the bottom, or additional steel as is required by the structural conditions. Forms shall be furnished with drilled steel members with sleeves welded below the holes to receive equipment anchor bolts where the anchor bolts fall in concrete locations. Height saving brackets shall be employed in all mounting locations. Height saving brackets shall be employed in all mounting locations to maintain a 1" clearance below the base.
B. Bases shall be type K as manufactured by Mason Industries, Inc. or equivalent by Vibration Eliminator Company or Amber Booth.
C. Application: Centrifugal pumps over 5 Hp and not slab on grade.

2.07 ROOF CURB BASES

A. Curb mounted rooftop equipment shall be mounted on vibration isolation bases that fit over the roof curb and under the isolated equipment. The extruded aluminum top members shall overlap the bottom member to provide water runoff independent of the seal. The aluminum member shall house cadmium plated springs having a 1 inch, 2 inch minimum deflection with 50% addition travel to solid. Spring diameters shall be no less than 0.8 of the spring height at rated load. Wind resistance shall be provided by means of resilient snubbers in the corners with a minimum clearance of 1/4" so as not to interfere with the spring action except in high winds. The weather seal shall consist of continuous closed cell sponge materials both above and below the base and a waterproof flexible duct like connection joining the outside perimeter of the aluminum members. Foam or other contact like seals are unacceptable at the spring cavity closure. Caulking shall be kept to a minimum.
A. Curb mounted bases shall be type CMAB as manufactured by Mason Industries or equivalent by Vibration Eliminator Company, Amber Booth, Thi-Curb, Custom Curb or R.P.S.
B. Application: Roof mounted A/C units, air handling units and separated condensing units.

PART 3 - EXECUTION

3.01 VIBRATION CONTROL DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Architectural specification sections.
B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
C. Select the appropriate base to match the equipment being provided. Base shall meet the exact dimensional and weight requirements at all points of the curb. Install as recommended by the vibration isolator manufacturer.

END OF SECTION

SECTION 23 05 50 - FIRE STOPPING

PART 1 - GENERAL

1.01 SUMMARY

A. Refer to Section 23 05 00 for requirements which are applicable to this section.
B. Refer to International Building Codes.
C. Section includes.
   1. Through penetration firestops and smoke-stops for all fire rated bearing and non-bearing wall and floor assemblies, both blank (empty) and those accommodating penetrating items such as cables, conduits, pipes, ducts, etc.

1.02 REFERENCES

A. American Society for Testing and Materials Standards (ASTM):
   1. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM E814: Standard Test method for Fire Tests of Through-Penetration Firestops.
B. Underwriters Laboratories, Inc.:
   1. UL 723 Surface Burning Characteristics of Building Materials
   2. UL 1479 Fire Tests of Through-Penetration Firestops.
C. UL Fire Resistance Directory:
   1. Through Penetration Firestop Devices (XHJI)
   2. Fire Resistive Ratings (BXUV)
   3. Through Penetration Firestop Systems (XHEZ)
   4. Fill, Void, or Cavity Material (XHHW)

1.03 DEFINITIONS

A. FIRESTOPPING: The use of a material or combination of materials in a fire rated structure (wall or floor) where it has been breached, so as to restore the integrity of the fire rating on that wall or floor.
B. SYSTEM: The use of a specific firestop material or combination of materials in conjunction with a specific wall or floor construction type and a specific penetrant(s), constitutes a “System.”
C. BARRIER: Any bearing or non-bearing wall or floor that has an hourly fire and smoke rating.
D. THROUGH-PENETRATION: Any penetration of a fire rated wall or floor that completely breaches the barrier.
E. MEMBRANE-PENETRATION: Any penetration in a fire rated wall that breaches only one side of the barrier.
F. CONSTRUCTION GAPS: any gap, joint, or opening, whether static or dynamic, where the top of a wall may meet a floor; wall to wall applications; edge to edge floor configurations; floor to exterior wall; or any linear breach in a rated barrier. Where movement is required, the firestopping system must comply with UL2079 for dynamic joints.

1.04 SUBMITTALS

NOTE: A “Certificate of Conformance,” from the manufacturers listed in Section “2.02 Acceptable Manufacturers,” is required with the “Submittal Package” to ensure that the material selected meets all of the criteria of this specification as set forth in Section “1.05 Quality Assurance.”

A. Submit manufacturer’s product literature for each type of firestop material to be installed. Literature shall indicate product characteristics, typical uses, performance and imitation criteria, and test data. Submittal should be in compliance with Section 23 05 00.
B. Material Safety Data Sheets (MSDS): Submit MSDS for each firestop product.
C. UL Tested Systems: Submit drawings showing typical installation details for the methods of installation. Indicate which firestop materials will be used and thickness for different hourly ratings.
D. Engineering Judgments: Submit manufacturer’s drawings for all non-standard applications where no UL rested system exists. All drawings must indicate the “Tested” UL system upon which the judgment is based so as to assess the relevance of the judgment to some known performance.
E. Submit manufacturer’s installation procedures for each type of product.
F. Approved Applicator: Submit document from manufacturer wherein manufacturer recognizes the installer as qualified or submit a list of past projects to demonstrate capability to perform intended work.
G. Upon completion, installer shall provide written certification that materials were installed in accordance with the manufacturer’s installation instructions and details.

1.05 QUALITY ASSURANCE

A. Firestopping systems (materials and design):
    1. Shall conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of field conditions.
    2. The F rating must be minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated. T rating when required by code authority shall be based on measurement of the temperature rise on penetrating item(s). The fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column joints, must be tested to UL 2079 with movement capabilities equal to those of the anticipated conditions.
B. Firestopping materials and systems must be capable of closing or filling through openings created by 1) the burning or melting of combustible pipes, cable jacketing, or pipe insulation materials, or 2) deflection of sheet metal due to thermal expansion (electrical & mechanical duct work).
C. Firestopping material shall be asbestos and lead free and shall not incorporate nor require the use of hazardous solvents.
D. Firestopping sealants must be flexible, allowing for normal pipe movement.
E. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.
F. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.
G. All firestopping materials shall be manufactured by one manufacturer (to the maximum extent possible).
H. Installation of firestopping systems shall be performed by a contractor (or contractors) trained

or approved by the firestop manufacturer.

I. Material used shall be in accordance with the manufacturer's written installation instructions.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver material in the manufacturer's original, unopened containers or packages with the manufacturer's name, product identification, lot number, UL label and mixing and installation instructions as applicable.
B. Store materials in the original, unopened containers or packages and under conditions recommended by the manufacturer.
C. All firestop materials will be installed prior to expiration of shelf life.

1.07 PROJECT CONDITIONS

A. Conform to manufacturer's printed instructions for installation and when applicable, curing in accordance with temperature and humidity. Conform to ventilation and safety requirements.
B. Verify the condition of the substrates before starting work.
C. Weather Conditions: Do not proceed with installation of firestop materials when temperatures fall outside the manufacturer's suggested limits.
D. Care should be taken to ensure that firestopping materials are installed so as not to contaminate adjacent surfaces.

1.08 SEQUENCING

A. Schedule firestopping after installation of penetrants but prior to concealing the openings.
B. Firestopping shall precede gypsum board finishing.

1.09 PROTECTION

A. Where firestopping is installed at locations which will remain exposed in the completed work, provide protection as necessary to prevent damage to adjacent surfaces and finishes, and protect as necessary against damage from other construction activities.

PART 2 - PRODUCTS

2.01 GENERAL

A. Firestopping materials and systems shall meet the requirements specified herein.
B. Architect must approve in writing any alternates to the materials and system specified herein.
C. All firestop products and systems shall be designed and installed so that the basic sealing system will allow the full restoration of the thermal and fire resistance properties of the barrier being penetrated with minimal repair if penetrants are subsequently removed.
D. For applications where combustible penetrants are involved, i.e., insulated, and plastic pipe, a suitable intumescent material must be used.

2.02 ACCEPTABLE MANUFACTURERS

NOTE: Inclusion of materials in this specification does not indicate that the listed products have been evaluated for conformance to this specification. Therefore, the user/contractor must certify in the submittal package, with a “Certificate of Conformance” from the manufacturers listed below, that the material selected meets all of the criteria set forth in Section “1.05 Quality Assurance” of this specification.

A. Specified Technologies, Inc./GE Pensil® (STI), Somerville, NJ 08876, Phone: (800) 992-1180.
B. 3M Fire Protection Products, St. Paul, MN

2.03 MATERIALS

A. Intumescent Firestop Sealants and Caulks:
   1. STI SpecSeal SSS100
   2. 3M Fire Barrier Caulk CP25WB+
B. Latex Firestop Sealant
   1. STI SpecSeal LC150 Sealant
C. Elastomeric Water-Based Sealant
   1. STI SpecSeal ES100 Elastomeric Sealant
D. Silicone Firestop Sealants and Caulks:
   1. STI SpecSeal Pensil 300\
   2. 3M Fire Barrier Silicone Sealants
E. Firestop Putty:
   1. STI SpecSeal Firestop Putty Bars and Pads
   2. 3M Fire Barrier Moldable Putty
F. Firestop Collars:
   1. STI Spec Seal Firestop Collars
   2. 3M Fire Barrier PPD’s.
G. Wrap Strips:
   1. SpecSeal Wrap Strip
   2. 3M Fire Barrier FS195 Wrap Strip.
H. 2-Part Silicone Firestop Foam:
   1. STI SpecSeal Pensil 200
   2. 3M Fire Barrier 2001 Silicone Foam.
I. Firestop Mortar:
   1. STI SpecSeal Mortar.
J. Firestop Pillows:
   1. STI SpecSeal Pillows
K. Elastomeric Spray:
   1. STI SpecSeal AS Elastomeric Spray
L. Composite Board:
   1. 3M Barrier Sheet Material
M. Accessories:

2.04 Forming/Damming Materials: Mineral fiberboard or other type as per manufacturer recommendation.

PART 3 - CONDITIONS REQUIRING FIRESTOPPING

3.01 General:

A. Provide firestopping for conditions specified whether or not firestopping is indicated, and if indicated, whether such material is designed as insulation, safing, or otherwise.
B. Through-Penetrations:
   1. Firestopping shall be installed in all open penetrations and in the annular space in all penetrations in any bearing or non-bearing fire-rated barrier.
C. Membrane-Penetrations:
   1. Where required by code, all membrane-penetrations in rated walls shall be protected with firestopping products that meet the requirements of third party time/temperature testing.
D. Construction Joints/Gaps:
   1. Fire Stopping shall be provided:
      a. Between the edges of floor slabs and exterior walls.
      b. Between the tops of walls and the underside of floors
      c. In the control joint in masonry walls and floors
      d. In expansion joints.
E. Smoke-Stopping:
   1. As required by the other Sections, Smoke-Stops shall be provided for Through-Penetrations, Membrane-) Penetrations, and Construction Gaps with a material approved and tested for such application.

3.02 EXAMINATION

A. Examine the areas and conditions where firestops are to be installed and notify the architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected by the contractor in a manner acceptable to the architect and in accordance with Section 01039.
B. Verify that environmental conditions are safe and suitable for installation of firestop products.
C. Verify that all pipe, conduit, cable, and other items which penetrate fire-rated construction have been permanently installed prior to installation of firestops.

3.03 INSTALLATION

A. General:
   1. Installation of firestops shall be performed by an applicator/installer qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
   2. Apply firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations.
   3. Unless specified and approved, all insulation used in conjunction with through-penetrants shall remain intact and undamaged and may not be removed.

4. Seal holes and penetrations to ensure an effective smoke seal.
5. In areas of high traffic, protect firestopping materials from damage. If the opening is large, install firestopping materials capable of supporting the weight of a human.
6. Insulation types specified in other sections shall not be installed in lieu of firestopping material specified herein.
7. All combustible penetrants (e.g., Non-metallic pipes or insulated metallic pipes) shall be fire stopped using products and systems tested in a configuration representative of the field condition.

B. Dam Construction: When required to properly contain firestopping materials within openings damming or packing materials may be utilized. Combustible damming material must be removed after appropriate curing. Non-combustible damming materials may be left as a permanent component of the firestop system.

3.04 FIELD QUALITY CONTROL

A. Prepare and install firestopping systems in accordance with manufacturer's printed instructions and recommendations.
B. Follow safety procedures recommended in the Material Safety Data Sheets.
C. Finish surfaces of firestopping which are to remain exposed in the completed work to a uniform and level condition.
D. All areas of work must be accessible until inspection by the applicable Code Authorities.
E. Correct unacceptable firestops and provide additional inspection to verify compliance with this specification.

3.05 CLEANING

A. Remove spilled and excess materials adjacent to firestopping without damaging adjacent surfaces.
B. Leave finished work in neat, clean condition with no evidence of spill overs or damage to adjacent surfaces.

END OF SECTION

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS

A. Metal Labels for Equipment:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Brady Corporation.
b. Brimar Industries, Inc.
c. Carlton Industries, LP.
d. Champion America.
e. Craftmark Pipe Markers.
f. emedco.
g. Kolbi Pipe Marker Co.
h. LEM Products Inc.
i. Marking Services, Inc.
j. Seton Identification Products.
2. Material and Thickness: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: White.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2 ½ by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brady Corporation.
      b. Brimar Industries, Inc.
      c. Carlton Industries, LP.
      d. Champion America.
      e. Craftmark Pipe Markers.
      f. emedco.
      g. Kolbi Pipe Marker Co.
      h. LEM Products Inc.
      i. Marking Services, Inc.
      j. Seton Identification Products.
   2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving,1/8 inch thick, and having predrilled holes for attachment hardware.
   3. Letter Color: Black.
   4. Background Color: White.
   5. Maximum Temperature: Able to withstand temperatures up to 160 deg. F.
   6. Minimum Label Size: Length and width vary for required label content, but not less than 2 ½ by 3/4 inch.
   7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
   8. Fasteners: Stainless-steel self-tapping screws.
   9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8 ½ by 11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Brady Corporation.
   2. Brimar Industries, Inc.
   3. Carlton Industries, LP.
   4. Champion America.
   5. Craftmark Pipe Markers.
   6. emedco.
   7. LEM Products Inc.
   8. Marking Services Inc.

9. National Marker Company.
10. Seton Identification Products.
11. Stranco, Inc.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
C. Letter Color: Black.
D. Background Color: White
E. Maximum Temperature: Able to withstand temperatures up to 160 deg. F.
F. Minimum Label Size: Length and width vary for required label content, but not less than 2 ½ by 3/4 inch.
G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
H. Fasteners: Stainless-steel self-tapping screws.
I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
J. Label Content: Include caution and warning information plus emergency notification instructions.

2.03 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
2. Brady Corporation.
3. Brimar Industries, Inc.
4. Carlton Industries, LP.
5. Champion America.
6. Craftmark Pipe Markers.
7. emedco.
8. Kolbi Pipe Marker Co.
9. LEM Products Inc.
10. Marking Services Inc.
11. Seton Identification Products.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping. At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.04 DUCT LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Brady Corporation.
   2. Brimar Industries, Inc.
   3. Carlton Industries, LP.
   4. Champion America.
   5. Craftmark Pipe Markers.
   6. emedco.
   7. Kolbi Pipe Marker Co.
   8. LEM Products Inc.
   9. Marking Services Inc.
   10. Seton Identification Products.
B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
C. Letter Color: Black.
D. Background Color: White.
E. Maximum Temperature: Able to withstand temperatures up to 160 deg. F.
F. Minimum Label Size: Length and width vary for required label content, but not less than 2 ½ by 3/4 inch.
G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
H. Fasteners: Stainless-steel self-tapping screws.
I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
J. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.
   1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.
B. Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Section 099123 "Interior Painting." Section 099600 "High-Performance Coatings."

B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet areas of congested piping and equipment.

C. Pipe Label Color Schedule:
   1. Chilled-Water Piping: White letters on a safety-green background.
   2. Condenser-Water Piping: White letters on a safety-green background.
   3. Heating Water Piping: White letters on a safety-green background.
   4. Refrigerant Piping: Black letters on a safety-orange background.
   5. Low-Pressure Steam Piping: White letters on a safety-purple background.
   6. High-Pressure Steam Piping: White letters on a safety-purple background.
   7. Steam Condensate Piping: White letters on a safety-purple background.

3.04 DUCT LABEL INSTALLATION

A. Install plastic-laminated self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
   1. Blue: For cold-air supply ducts.
   2. Yellow: For hot-air supply ducts.
   3. Green: For exhaust, outside, relief, return, and mixed-air ducts.

B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Balancing Air Systems:
      a. Constant-volume air systems.

1.02 DEFINITIONS

A. AABC: Associated Air Balance Council.
B. NEBB: National Environmental Balancing Bureau.
C. TAB: Testing, adjusting, and balancing.
D. TABB: Testing, Adjusting, and Balancing Bureau.
E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
F. TDH: Total dynamic head.

1.03 INFORMATIONAL SUBMITTALS

A. Certified TAB reports.

1.04 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC or NEBB.
   1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC or NEBB.
   2. TAB Technician: Employee of the TAB specialist and certified by AABC or NEBB as a TAB technician.
B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to

discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.
   1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
   2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.

L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures for balancing the systems.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
   1. Airside:
      a. Duct systems are complete with terminals installed.
      b. Volume, smoke, and fire dampers are open and functional.
      c. Clean filters are installed.

d. Fans are operating, free of vibration, and rotating in correct direction.
e. Variable-frequency controllers' startup is complete, and safeties are verified.
f. Automatic temperature-control systems are operational.
g. Ceilings are installed.
h. Windows and doors are installed.
i. Suitable access to balancing devices and equipment is provided.

2. Hydronics:
   a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
   b. Piping is complete with terminals installed.
   c. Water treatment is complete.
   d. Systems are flushed, filled, and air purged.
   e. Strainers are pulled and cleaned.
   f. Control valves are functioning per the sequence of operation.
   g. Shutoff and balance valves have been verified to be 100 percent open.
   h. Pumps are started, and proper rotation is verified.
   i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
   j. Variable-frequency controllers' startup is complete and safeties are verified.
   k. Suitable access to balancing devices and equipment is provided.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
   1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
   2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
   3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow

measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
G. Verify that motor starters are equipped with properly sized thermal protection.
H. Check dampers for proper position to achieve desired airflow path.
I. Check for airflow blockages.
J. Check condensate drains for proper connections and functioning.
K. Check for proper sealing of air-handling-unit components.
L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."
M. The contractor shall allow for (2) passes for each heating and cooling season.
N. Allow for one sheave change for 50% of the HVAC systems to be tested and adjusted. Replacement sheave shall be furnished and installed by the mechanical contractor. Sheave shall be adjusted by the TBA contractor.

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
    1. Measure total airflow.
        a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
        b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
        c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
        d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
    2. Measure fan static pressures as follows:
        a. Measure static pressure directly at the fan outlet or through the flexible connection.
        b. Measure static pressure directly at the fan inlet or through the flexible connection.
        c. Measure static pressure across each component that makes up the air-handling system.
        d. Report artificial loading of filters at the time static pressures are measured.
    3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
    4. Obtain approval from Construction Manager for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
    5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.
1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

3.06 DUCTWORK LEAKAGE TESTING

A. Installed ductwork shall be tested prior to installation of access doors, take-offs, etc.

B. All leak testing shall be witnessed by the engineer or representative of the engineer. The contractor shall give the engineer 72 hours' notice prior to testing. Any testing not witnessed by the engineer or his/her representative shall be considered invalid and will be redone.

C. The testing shall be performed as follows:
1. Perform testing in accordance with HVAC Air Duct Leakage Test Manual.
2. Use a certified orifice tube for measuring the leakage.
3. Determine section of system to be tested and blank off.
4. Determine the percentage of the system being tested.
5. Using that percentage, determine the allowable leakage (cfm) for that section being tested.
6. Pressurize to operating pressure and repair any significant or audible leaks.
7. Repressurize the measure leakage.
8. Repeat steps 6 and 7 until the leakage measured is less than the allowable defined in step 5.

NOTE: It is recommended that the first 100'-300' of ductwork installed be tested to insure the quality of the workmanship at an early stage.

3.07 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.08 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:
1. Pump curves.

2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:
    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:
    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
    a. Unit identification.
    b. Location.
    c. Make and type.

d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches, and bore.
i. Center-to-center dimensions of sheave and amount of adjustments in inches.
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:
   a. Motor make, and frame type and size.
   b. Horsepower and rpm.
   c. Volts, phase, and hertz.
   d. Full-load amperage and service factor.
   e. Sheave make, size in inches, and bore.
   f. Center-to-center dimensions of sheave and amount of adjustments in inches.
3. Test Data (Indicated and Actual Values):
   a. Total airflow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan rpm.
   d. Discharge static pressure in inches wg.
   e. Filter static-pressure differential in inches wg.
   f. Preheat-coil static-pressure differential in inches wg.
   g. Cooling-coil static-pressure differential in inches wg.
   h. Heating-coil static-pressure differential in inches wg.
   i. Outdoor airflow in cfm.
   j. Return airflow in cfm.
   k. Outdoor-air damper position.
   l. Return-air damper position.
   m. Vortex damper position.

F. Instrument Calibration Reports:
   1. Report Data:
      a. Instrument type and make.
      b. Serial number.
      c. Application.
      d. Dates of use.
      e. Dates of calibration.

3.09 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of the Construction Manager.
B. The Construction Manager shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:
   1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
   2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
   3. If the second verification also fails, the Owner may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.10 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 07 13 - DUCT INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes insulating the following duct services:
   1. Indoor, concealed supply and outdoor air.
   2. Indoor, exposed supply and outdoor air.
   3. Indoor, concealed return located in unconditioned space.
   4. Indoor, exposed return located in unconditioned space.
   5. Outdoor, concealed supply and return.
   6. Outdoor, exposed supply and return.

B. Related Sections:
   1. Section 230719 "HVAC Piping Insulation."
   2. Section 233113 "Metal Ducts" for duct liners.

C. Insulation to be in accordance with ASHRAE 90.1-2016.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:
   1. For each type of insulation product indicated, include thermal conductivity, water-vapor permeability for closed cell insulations, thickness, applicable ASTM standard specification, and jackets (both factory- and field-applied, if any). For each type of vapor retarder or jacket specified, include water vapor permeability, required thickness, and applicable ASTM standard specification.
   2. Product Data: For adhesives, indicating VOC content.
   3. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
   4. Product Data: For coatings, indicating VOC content.
   5. Laboratory Test Reports: For coatings, indicating compliance with requirements for low-emitting materials.
   6. Product Data: For sealants, indicating VOC content.
   7. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail insulation application at elbows, fittings, dampers, specialties, and flanges for each type of insulation.
   3. Detail application of field-applied jackets.
   4. Detail application at linkages of control devices.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.04 QUALITY ASSURANCE

A. Install insulation in accordance with the manufacturer's instructions.
B. Material Certifications: Manufacturers can provide information regarding material and testing certifications from a qualified testing agency acceptable to authorities having jurisdiction (AHJ). The AHJ can use this information for indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. (Many companies published compliance data on public data sheets while also offering technical resources for additional information. The wording was adjusted to reflect this.)
C. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency. Suggestion: or proper documentation indicating compliance. (Some fabricated materials used by the industry do not come directly from the manufacturer, so this documentation can be provided in those cases).
    1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871. Products that come in contact with austenitic stainless steel operating at temperatures between 140°F and 250°F shall have a leachable chloride content in accordance with the limits set by ASTM C795 (Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel).
D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795. See above.
E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, [Type I] Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        a. CertainTeed Corporation.
        b. Johns Manville; a Berkshire Hathaway company.
        c. Knauf Insulation.
        d. Manson Insulation Inc.
        e. Owens Corning.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA, or Type IB. For duct and plenum applications, provide insulation with factory applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CertainTeed Corporation.
      b. Johns Manville; a Berkshire Hathaway company.
      c. Knauf Insulation.
      d. Manson Insulation Inc.
      e. Owens Corning.

2.02 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. 3M.
      b. CertainTeed Corporation.

2.03 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand; H. B. Fuller Construction Products.
      b. Eagle Bridges - Marathon Industries.
      c. Foster Brand; H. B. Fuller Construction Products.
      d. Mon-Eco Industries, Inc.
   2. Fiberglass adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand; H. B. Fuller Construction Products.
      b. Eagle Bridges - Marathon Industries.
      c. Foster Brand; H. B. Fuller Construction Products.
      d. Mon-Eco Industries, Inc.
   2. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   3. Adhesive shall comply with the testing and product requirements of the California

Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. PVC Jacket Adhesive: Compatible with PVC jacket.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dow Corning Corporation.
      b. Johns Manville; a Berkshire Hathaway company.
      c. P.I.C. Plastics, Inc.
      d. Speedline Corporation.
   2. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.04 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
   1. VOC Content: 420 g/L or less.
   2. Low-Emitting Materials: Mastic coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Foster Brand; H. B. Fuller Construction Products.
      b. Knauf Insulation.
      c. Vimasco Corporation.
   2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
   3. Service Temperature Range: Minus 20 to plus 180 deg. F.
   4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
   5. Color: White.

2.05 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand; H. B. Fuller Construction Products.
      b. Eagle Bridges - Marathon Industries.
      c. Foster Brand; H. B. Fuller Construction Products.
      d. Mon-Eco Industries, Inc.
   2. Materials shall be compatible with insulation materials, jackets, and substrates.
   3. Fire- and water-resistant, flexible, elastomeric sealant.
   4. Service Temperature Range: Minus 40 to plus 250° F.

5. Color: Aluminum.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Childers Brand; H. B. Fuller Construction Products.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250° F.
5. Color: White.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.06 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.

B. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.07 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for ducts.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Childers Brand; H. B. Fuller Construction Products.

2.08 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Johns Manville; a Berkshire Hathaway company.
   b. P.I.C. Plastics, Inc.
   c. Proto Corporation.
   d. Speedline Corporation.
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.

D. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. ITW Insulation Systems; Illinois Tool Works, Inc. Johns Manville
   c. RPR Products, Inc.
2. [Sheet and roll stock ready for shop or field sizing] [Factory cut and rolled to size].
3. Finish and thickness are indicated in field-applied jacket schedules.
4. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
5. Moisture Barrier for Outdoor Applications: 2.5-mil- thick polysurlyn.

E. Self-Adhesive Outdoor Jacket: 6014-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross laminated polyethylene film covered with white aluminum-foil facing.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Polyguard Products, Inc.
   b. VentureClad by 3M

2.09 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Avery Dennison Corporation, Specialty Tapes Division.
   b. Compac Corporation.
   c. Ideal Tape Co., Inc., an American Biltrite Company.
   d. Knauf Insulation.
   e. Venture Tape.
2. Width: 3 inches
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces' force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division.
b. Compac Corporation.
c. Ideal Tape Co., Inc., an American Biltrite Company.
d. Knauf Insulation.
e. Venture Tape.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces' force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Avery Dennison Corporation, Specialty Tapes Division.
b. Compac Corporation.
c. Ideal Tape Co., Inc., an American Biltrite Company.
d. Knauf Insulation.
e. Venture Tape.
2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces' force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ITW Insulation Systems; Illinois Tool Works, Inc.
b. RPR Products, Inc.

B. Insulation Pins and Hangers:
1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1) AGM Industries, Inc.
2) Gemco.
3) Hardcast, Inc.
4) Midwest Fasteners, Inc.
5) Nelson Stud Welding.
b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Aluminum, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
d. Adhesive: Recommended by hanger manufacturer. Product with

demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Gemco.
      2) Midwest Fasteners, Inc.
   b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1 ½ inches in diameter.
   c. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2 ½ inches.
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) AGM Industries, Inc.
      2) Gemco.
      3) Hardcast, Inc.
      4) Midwest Fasteners, Inc.
   b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   c. Spindle: Aluminum, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
   d. Adhesive-backed base with a peel-off protective cover.
4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1 ½ inches in diameter.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) AGM Industries, Inc.
      2) Gemco.
      3) Hardcast, Inc.
      4) Midwest Fasteners, Inc.
      5) Nelson Stud Welding.
   b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
   c. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1 ½ inches in diameter.
   d. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Gemco.
      2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
D. Wire: 0.062-inch soft-annealed, galvanized steel.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. C & F Wire.

2.11 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
E. Install multiple layers of insulation with longitudinal and end seams staggered.
F. Keep insulation materials dry during storage, application, and finishing.
G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
H. Install insulation with least number of joints practical.
I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1 ½ inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.03 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
   4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
   4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
   1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:
1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.04 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches' maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches' maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not over compress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg. F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive, tape, and insulation pins. Follow manufacturer's installation instructions.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not over compress insulation during installation.
   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1-inch o.c. Install vapor barrier consisting of factory or field applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50°F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.05 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.

3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1 ½ -inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.06 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
B. Insulate duct access panels and doors to achieve same fire rating as duct.
C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

3.07 FINISHES

A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
C. Do not field paint aluminum or stainless-steel jackets.
D. Local building code and fire marshal shall approve before painting.

3.08 FIELD QUALITY CONTROL

A. Perform tests and inspections. Engage a qualified testing agency to perform tests and inspections.
B. Tests and Inspections:
1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.09 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:
   1. Indoor, concealed supply, return and outdoor air.
   2. Indoor, exposed supply and outdoor air.
   3. Indoor, concealed return located in unconditioned space.
   4. Indoor, exposed return located in unconditioned space.
   5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
   6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
   7. Indoor, concealed oven and warewash exhaust.
   8. Indoor, exposed oven and warewash exhaust.
   9. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
   10. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
   11. Outdoor, concealed supply, return, locker room / shower exhaust.
   12. Outdoor, exposed supply, return, locker room / shower exhaust.

B. Items Not Insulated:
   1. Fibrous-glass ducts.
   2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
   3. Factory-insulated flexible ducts.
   4. Factory-insulated plenums and casings.
   5. Flexible connectors.
   6. Vibration-control devices.
   7. Factory-insulated access panels and doors.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 0.75-lb/cu. Ft. nominal density. “R” value of 4.2.

B. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 0.75-lb/cu. Ft nominal density. “R” value of 4.2.

C. Concealed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 0.75-lb/cu. Ft nominal density. “R” value of 4.2.

D. Concealed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 0.75-lb/cu. Ft. nominal density. “R” value of 4.2.

E. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 3-lb/cu. ft. nominal density. “R” value of 4.2.

F. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 3-lb/cu. ft. nominal density. “R” value of 4.2.

G. Exposed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 3-lb/cu. ft. nominal density. “R” value of 4.2.

H. Exposed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 3-lb/cu. ft. nominal density. “R” value of 4.2.

3.11 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
   1. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber board 3 inches thick and 6-lb/cu. ft. nominal density. “R” value of 8.3.

2. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber board, 3 inches thick and 6-lb./cu. ft. nominal density. “R” value of 8.3.
3. Concealed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber board, 3 inches thick and 6-lb/cu. ft. nominal density. “R” value of 8.3.
4. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber board, 3 inches thick and 6-lb/cu. ft. nominal density. “R” value of 8.3.
5. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber board, 3 inches thick and 6-lb/cu. ft. nominal density. “R” value of 8.3.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
B. If more than one material is listed, selection from materials listed is Contractor's option.
   1. Ducts and Plenums, Concealed:
      a. None.
   2. Ducts and Plenums, Exposed:
      a. Aluminum, Smooth: 0.020 inch thick.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
B. If more than one material is listed, selection from materials listed is Contractor's option.
   1. Ducts and Plenums, Concealed:
      a. None.
   2. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches.
      a. Aluminum, Smooth: 0.024 inch thick.

END OF SECTION

SECTION 23 09 33 - AUTOMATIC TEMPERATURE CONTROL

PART 1 - GENERAL

1.01 REFERENCE

A. Refer to section 23 05 00 for requirements which are applicable to this section.
B. Refer to International Mechanical Code.
C. Refer to National Electrical Code.

1.02 WORK INCLUDED

A. Provide all labor, material, equipment, and supervision necessary to install a complete, functioning, Automatic Temperature Control (ATC) system.
B. Power wiring will be provided under the Electrical portion of the work.
C. Control wiring shall be furnished under this portion of the work. Control wiring is line voltage or low voltage if it performs as control wiring. Power for operation of valves and dampers is considered control wiring.
D. ATC contractor/mechanical contractor to arrange for power for control equipment with electrical contractor. Allow for compensation to the electrical contractor to install a power source which may be required.
E. The mechanical contractor shall be responsible for the complete coordination of all parts of the ATC system whether they be part of packaged control systems within units or built up systems by ATC providers. It is the intent that all systems and subsystems to be coordinated and to be provided to produce the following sequences described in this specification.
F. All control wiring shall be CAT 6 plenum rated. All control wiring shall run concealed in finished spaces. Control wiring to be in conduit in exposed interior unfinished areas and where subject to damage. All exterior exposed control wiring to be in conduit and weather protected. Conduit to be EMT or galvanized steel. No pvc piping is permitted in plenums.
G. Exposed control wiring in interior finished spaces;
    1. Control wiring to run in Wiremold V500 series. (steel raceway, ¾") and associated fittings.
    2. Finish to be selected by architect.
    3. Contractor to coordinate all final Wiremold run locations and layout with architect/engineer for approval prior to ordering and rough-in.
H. ATC contractor to be present at equipment/system start-up and verify that all wiring and components are installed correctly and the equipment/system sequence of operation is operating as designed. ATC contractor to perform final calibrations of all devices and equipment. ATC contractor to make all the required corrections if the equipment/system does not operate correctly.
I. ATC contractor to coordinate with the test, balancing, and adjusting (TBA) contractor prior to performing equipment/systems tests that all air systems have been tested and balanced.

1.03 SUBMITTALS

A. Submit shop drawings of all components.
B. Submit manufacturers' data sheets of valve Cv performance.
C. Submit design data and sequence of operations descriptions for all systems.
D. Submit wiring diagrams of electrical or electronic control systems.
E. At the completion of the project, submit final “as-built” drawings/CAD disk, all associated component/equipment cut-sheets/submittals, wiring diagrams, and final/actual sequence of operations descriptions of each system. Include ATC emergency contact information.

1.04 QUALITY ASSURANCE

A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.
B. Work shall be performed by skilled tradesmen normally engaged in the control systems trade.

PART 2 - PRODUCTS

2.01 CONTROL DEVICES - GENERAL

A. All control devices and products used in the control system shall be first-line products, manufactured for the application as used.
B. All thermostats shall have guards. Thermostat guards shall be plastic or metal covers to prevent tampering with the instrument. Provide substantial, locked, opaque cover, hinged to a base which is secured to the wall, not to the thermostat base.
C. Control valves for fluids shall be two-position (On-Off), modulating two-position, three-way, or modulating three-way (mixing or diverter), as required for the application. Modulating valves shall be selected with the proper flow characteristics to allow control of the flow over as wide a range as is possible with a reasonable maximum pressure drop (7 ft.) of water unless noted otherwise.

2.02 ECONOMIZER

A. HVAC units shall be provided with economizer controls where indicated on the drawings or elsewhere in these specifications or on any system 4 tons or over. Enthalpy selection system shall consist of one enthalpy transmitter in the outside air, one enthalpy transmitter in the return air, and a relay to select the lower of the two enthalpies. In operation, the signal from the two enthalpy transmitters shall be compared by the differential switching relay so that when the outside air enthalpy is lower than the return air enthalpy, the temperature control system shall modulate the outside, return, and relief dampers to supply up to 100% outside air for "free cooling". When the outside air enthalpy is higher than the return air, the system shall position to minimum outside air. The use of separate temperature and humidity transmitters to arrive at enthalpy is not acceptable. Outside air transmitter shall not be damaged by operation during fog conditions.
B. The economizer module shall be ASHRAE 90.1 compliant (latest version).
C. The module shall have a local display screen for diagnostics at the unit.

D. On projects with building automation systems the economizer shall have a BACNET output and shall be interconnected to the building automation system.
E. The module shall have fault detection diagnostics.
F. Manufacturer: Belimo Zip Economizer series. Equal by Honeywell.

2.03 CONTROL DEVICES - ELECTRICAL

A. All electrical wiring for the control system shall be as specified in this section and the Electrical Section of the Specifications and as required by local codes. The wiring shall be by this contractor.
B. All thermostats to be 24hr./7 day programmable type, auto changeover type, +/-3 degree adjustment capability (when integrated with building automation system), WIFI capability. Manufacturer: Honeywell. Provide locking cover (clear plastic, hinged type).

2.04 ACCEPTABLE MANUFACTURERS

A. Control equipment shall be manufactured by a company regularly engaged in production of this type of equipment, as shown on the drawings, or equivalent equipment by Honeywell, Johnson Controls, Alerton, Schneider Electric, Delta, or prior approved equals.

2.05 DAMPER AND VALVE ACTUATORS

A. All damper actuators (motors) installed in conjunction with an Air Handler/HVAC unit must be of the spring return, 2 position, occupied/unoccupied type, or modulating where an economizer cycle is required.
B. Combustion air damper actuators shall be of the 2 position, spring return type.

2.06 RELAYS AND SIGNAL TRANSMITTERS

A. All necessary relays, contacts, and interface devices shall be furnished to make the system a full and operable system.

2.07 DUCT SMOKE DETECTORS

A. Duct smoke detectors shall be of the photo-electronic type with sampling tube of ample length to traverse the entire width of the duct. Duct smoke detectors shall be manufactured by the control companies, the fire alarm companies, B.R.K. Electronics or approved equal. All HVAC units of 2000 CFM or more shall have duct smoke detectors in both the supply and return air streams. A single duct smoke detection in the return air stream shall be provided only when acceptable to the local authority having jurisdiction.
B. Duct smoke detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity and alarm condition, and individually adjustable for sensitivity from the FACP.
C. Units of 15,000 CFM or more shall have two detectors. (supply and return air)
D. Furnish and install where indicated on the drawings or required elsewhere in the specifications air duct smoke detectors. They shall integrate photoelectric, ionization and heat sensing technologies for optimum detection accuracy and to prevent unwanted alarms. Auxiliary contacts shall be provided to shut down the air handling unit fan. The detector shall output to a remote alarm indicator.
E. Duct smoke detectors to be furnished by the electrical contractor.

F. Duct smoke detectors shall be installed by the mechanical contractor.
G. Interconnection between the duct smoke detectors and fire alarm system shall be performed by the electrical contractor/fire alarm contractor.
H. Control's integration to shut down the HVAC equipment in alarm shall be performed by the mechanical contractor/ATC contractor.

2.08 FREEZESTATS

A. The freezestat shall be of the vapor pressure type with a 20 foot minimum element. Element shall respond to the lowest temperature sensed by any one foot section.
B. The freezestat shall be manual reset. Provide reset button and red indicator light. Location to be coordinated with architect.
C. All coils (heating hot water, chilled water, condenser water/water source) with outside air and hot water in ducts or units shall have freezestats.

2.09 MOTOR OPERATED DAMPERS

A. The motor operated dampers shall be of the parallel blade type for all 2-position applications such as the combustion air dampers and of the opposed blade type for all modulating applications including the outside air dampers for the heating, air conditioning, and ventilating units.
B. The damper frames shall be extruded aluminum not less than, 08" thick, thermally broken, roll-formed channel with prepunched slotted mounting holes. The damper blades shall be extruded aluminum insulated R-2.29.
C. Bearings shall be composed of a Celcon inner bearing with aluminum hexagon blade pivot pin, rotating within a poly carbonate outer bearing inserted in the frame. The dampers shall be equal to Tamco series 9000 ECT for parallel blade dampers and for opposed blade dampers.
D. Dampers shall have a closed leakage rate of not more than 1.4 CFM per sq. ft. for 3'x3' damper at 1" S.P leakage class 1A.

2.10 DIFFERENTIAL PRESSURE SWITCH

A. Differential pressure switches shall have adjustable set point and differential and be of the automatic reset, snap acting type as manufactured by Honeywell or approved equal.
B. +/- 5% accuracy, -1 to +1" P.G.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All control equipment shall be installed as recommended by the manufacturer and as required for service in the field. No equipment shall be concealed or covered by other equipment unless adequate provisions are made for service and replacement.
B. All wiring shall be run in neat, straight lines to present a finished appearance. Multiple runs shall be supported on brackets and spaced to give access to each line. Any work not neatly installed shall be removed and replaced.

C. All wires shall be color-coded and numbered on both ends of each conductor for easy identification. Colors and numbers shall not change in the middle of a run, unless an accessible junction box is provided. Provide numbered terminal strips in all control panels.
D. Wiring diagrams shall be prepared for all electrical connections, showing the actual wire number and terminal identification as installed. No less than three copies of such diagrams shall be delivered to the engineer as-built drawings.
E. Installation of all equipment shall be made by qualified mechanics familiar with control systems, forces involved, and their operation.
F. All connections shall be made by technicians who are familiar with the operation of the equipment and the intent of the control designer.
G. After all equipment is mounted and connected, the control engineer shall inspect the system and verify the correct operation and connection of all equipment. Any equipment found to be installed improperly or connected incorrectly shall be changed as required. After the system is installed correctly, all instruments shall be calibrated and set points fixed at the correct setting.

3.02 TESTING/TRAINING

A. At the time of final review, the control contractor shall instruct the owner in the proper operation and maintenance of the system as installed and demonstrate how the system is designed to perform.
B. At completion of the training, the contractor shall submit a letter stating the owner has received proper training, date, time, and location of training and name of the trainee.
C. Any system found to be out of calibration or functioning improperly at this time shall be corrected immediately and the correct functions of the entire system demonstrated to the satisfaction of the engineer.
D. The ATC contractor shall provide two (2 hour) training sessions for systems orientation, product maintenance, trouble shooting, and emergency contacts. ATC contractor to coordinate with owner/architect/engineer to determine representatives/designated staff to be present for the training.

3.03 WARRANTY PERIOD SERVICES

A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance by owner.
B. Within this period, upon notice by the Owner, any defects in the BAS due to faulty materials, methods of installation or workmanship shall be promptly repaired or replaced by the ATC Contractor at no expense to the Owner.
C. The ATC Contractor shall inspect, repair, replace, adjust and calibrate, as required, the controllers, control devices and associated peripheral units during the warranty period. The ATC Contractor shall then furnish a report describing the status of the equipment, problem areas (if any) noticed during service work and description of the corrective actions taken. The report shall clearly certify that all systems/equipment are functioning correctly.
D. Service Period: Calls for service by the Owner shall be honored within 24 hours and are not to be considered as part of routine maintenance.
E. Service Documentation: A copy of the service report associated with each owner-initiated service call shall be provided to the owner.

PART 4 - SEQUENCE OF OPERATIONS

4.01 GENERAL NOTES

A. The mechanical contractor shall retain a qualified ATC sub-contractor to furnish all labor, materials, equipment, and service necessary for a complete and operating ATC system, utilizing standalone controls as shown on the drawings and described herein.
B. The Mechanical Contractor shall provide all required sensor wells and all other work required to accommodate the installation of all controls work.
C. The mechanical contractor shall submit equipment submittals of all mechanical equipment to the ATC contractor for review prior to ordering the equipment.
D. The ATC contractor shall program the occupied and unoccupied schedules into the individual programmable thermostats, time clocks, etc. and coordinate the schedules with the owner.
E. The fire alarm sub-contractor shall provide all interconnecting wiring to the 24V emergency dry contacts on units needing to be interfaced with the fire alarm system. The ATC Contractor shall coordinate this connection with the electrical contractor and/or fire alarm sub-contractor.
F. Programmable thermostats, standalone space temperature and/or humidity sensors in public areas shall include a lockable cover (clear plastic hinged type).
G. All ATC wiring, components and installation shall comply with the National Electric Code. All ATC wiring, components and installation shall comply with the National Electric Code.
H. ATC contractor shall utilize low voltage conductors (solid or stranded) of the appropriate gauge and approved by the thermostat manufacturer.

4.02 PACKAGED VARIABLE COLUME DX/GAS HEATING UNITS

A. General
   1. Packaged unit shall be provided with a 24h/7day programmable thermostat for control of occupied and unoccupied cycles. Unit shall be capable of manual override of the time clock control.
B. Operation
   1. The supply fan shall operate continuously in occupied hours and cycle in unoccupied hours/evening hours.
   2. Ventilation air - during occupied hours, the outside air damper shall be open. During unoccupied and evening hours, the outside air damper shall be closed.
   3. Refer to Carbon Dioxide Reset sequence for control of the outside air damper.
   4. Supply fan speed shall vary to match the cooling/heating load. Unit shall work under its factory settings sequences. Contractor to set minimum and maximum airflows, to match schedule.
   5. Economizer - when the outside air temperature is lower than the space air temperature and the outside air dewpoint temperature is below 55ºF, the unit shall operate in 100% outside air mode with no mechanical cooling.
   6. Cooling - on a call for cooling, the unit shall operate the compressors to maintain 55ºF (adj.) Leaving air temperature.
   7. Dehumidification (hot gas reheat) - when the outdoor air temperature is between 55ºF and 85ºF, the hot gas reheat circuit shall operate to maintain a leaving air temperature of 75ºF (adj.).
   8. Heating - on a call for heating, the gas fired heating section shall operate to maintain

70ºF (adj.) In the space.

9. Provide a duct smoke detector in each unit 2,000 CFM or over in the return air connection and in the supply air ductwork.
10. Fire alarm shutdown – If the duct smoke detectors sense smoke, then any combination fire/smoke dampers shall close and the associated unit shall be de-energized. The unit shall not be permitted to operate until all trouble signals are cleared on the fire alarm system.

4.04 SMOKE DAMPERS (SD) AND COMBINATION FIRE/SMOKE DAMPERS (FSD)

A. Smoke dampers (SD) and combination fire/smoke dampers (FSD) shall be furnished by the mechanical contractor and installed by the mechanical contractor (or sheet metal sub-contractor). The electrical contractor shall provide 120V power to all smoke dampers and combination fire/smoke dampers (refer to electrical drawings). The fire alarm sub-contractor shall wire the smoke damper or combination fire/ smoke damper to the digital addressable fire alarm system.
B. Refer to cover sheet or equipment schedules for smoke damper and combination fire/smoke damper specification. Smoke dampers and combination fire/smoke dampers shall be power open, spring closed type (fail closed).
C. Smoke dampers and combination fire/smoke dampers shall be furnished with open / closed blade indication module (OCI). The fire alarm sub-contractor shall wire the OCI module to the addressable fire alarm system.
D. Addressable duct mounted smoke detectors or full area smoke detection shall be provided for each smoke damper and combination fire/smoke damper in accordance with international mechanical code section 607.3.3.
E. The addressable duct mounted smoke detectors shall be furnished by the fire alarm sub-contractor, mounted by the mechanical contractor (or sheet metal sub-contractor) and wired to the addressable fire alarm system by the fire alarm sub-contractor.

4.05 CARBON DIOXIDE RESET

A. The new packaged unit serving the cafeteria shall be provided with a carbon dioxide sensor.
B. Furnish and install a carbon dioxide space sensor which shall reset the outside air damper position to respond to occupancy carbon dioxide levels. Integrate with associated HVAC unit

controls.

C. Sensor shall be installed in a protective cover (clear plastic with locking cover). Coordinate final location with engineer.

D. The unit outside air damper shall be closed during unoccupied hours.

E. The unit outside air damper position shall be at its minimum position (750 cfm, see schedules) during occupied hours as a default.

F. On a rise in carbon dioxide levels above the set point (700 PPM) the outside air damper shall gradually open up to its maximum position (2,000 cfm of outside air. See schedule).

G. On a fall in carbon dioxide levels below the set point, the outside air damper shall gradually close down to its minimum default position.

4.06 DUCT MOUNTED SMOKE DETECTORS

A. In air systems with a capacity greater than 2,000 CFM, furnish and install duct mounted smoke detectors in the supply air (downstream the air filters and upstream of any branch duct) and return air ductwork.

B. The fire alarm sub-contractor shall furnish a fire alarm monitoring module for each required air handling system. The ATC Contractor shall wire the fire alarm monitoring module to the emergency shutdown contacts or combination motor starter/disconnect on each air handling system.

C. Detectors shall de-energize the unit and signal the addressable fire alarm system if smoke is detected.

D. Detectors shall be accessible. Mechanical contractor shall be responsible for providing all necessary access panels and doors.

E. Duct smoke detectors to be furnished by the Electrical Contractor.

END OF SECTION

SECTION 23 31 13 - METAL DUCTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Rectangular ducts and fittings.
   2. Round ducts and fittings.
   3. Sheet metal materials.
   4. Sound attenuating duct lining.
   5. Sealants and gaskets.
   6. Hangers and supports.

B. Related Sections:
   1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
   2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.02 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ANSI/ASHRAE 62.1.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Submittals:
   1. Product Data: For ventilation equipment, indicating compliance with ASHRAE 62.1, Section 5 - "Systems and Equipment."
   2. Product Data: For adhesives, indicating VOC content.
   3. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
   4. Product Data: For sealants, indicating VOC content.
   5. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings:
   1. Ductwork shop drawings must be properly submitted. Any ductwork installed without prior approval by the engineer and found to be incorrect, shall be replaced at the expense of the contractor.
   2. Submit shop drawings of all sheet metal for review. Drawings shall be not less than 1/4" scale and show all light fixtures, steel, piping, conduit, equipment and architectural features. It is unacceptable to resubmit and modify McHugh design

documents for sheet metal drawing purposes.

a. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
b. Factory- and shop-fabricated ducts and fittings.
c. Duct layout indicating sizes, configuration, CFM, and static-pressure classes.
d. Elevation of top of ducts. Verify ductwork fits in available space.
e. Dimensions of main duct runs from building grid lines.
f. Fittings.
g. Reinforcement and spacing.
h. Seam and joint construction.
i. Penetrations through fire-rated and other partitions.
j. Equipment
k. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
l. Hangers and supports, including methods for duct and building attachment and vibration isolation.
m. Indicate waste and storm piping where it occurs in the area of ductwork.
n. Locate electrical gear on plan. Ductwork is not to run above panels.
o. Ductwork is to be shown double line with indicated width and height.
p. Allowance to be made for lining and/or insulation.
q. Duct sizes shown on contract drawings may be flattened to a 4 to 1 ratio when necessary to establish clearance. Such transitions are to be included in the contract price.
r. Ductwork fabrication shall not proceed until shop drawings are submitted for review.
s. All dampers, grilles, registers, diffusers, access panels, louvers, coils, filters, and other components of the system are to be indicated.
t. Provide detail of fire damper assembly.
u. Provide drawing sections when requested by the engineer.
v. Coordinate sheet metal drawings with light fixture layout and sprinkler system piping and heads and shown on the drawing.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:
   a. Luminaires.
   b. Air outlets and inlets.
   c. Speakers.
   d. Sprinklers.
   e. Access panels.
   f. Perimeter moldings.

B. Welding certificates.

1.05 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
   2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
   3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.01 RECTANGULAR DUCTS AND FITTINGS – SMACNA STANDARDS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 FABRICATED DUCT REQUIREMENTS - DUCTMATE

A. All interior rectangular ducts shall be constructed with G-60 or better galvanized steel (ASTM A-653-94) LFQ, chem treat. Exterior ductwork shall be G-90 or better galvanized steel LFQ, chem treat. Kitchen, shower, or dishwasher exhaust shall be aluminum with aluminum joints.
B. Materials: Support, access doors not part of ducts, bar or angle reinforcing damper rods and items made of uncoated mild steel shall be painted with two coats of primer or provide galvanized equivalent.
C. Longitudinal Seams. Pittsburgh lock shall be used on all longitudinal seams. All longitudinal seams will be sealed with mastic sealant. Snaplock is not acceptable.
D. Flanged interior Gasket. Ductmate 440 or a Butyl Rubber Gasket which meets Mil-C

18969B, Type II Class B, TT-C-1796 A, Type II Class B, and TTS-S-001657 must also pass UL-723. This material, in addition to the above, shall not contain vegetable oils, fish oils, or any other type of vehicle that will support fungal and/or bacterial growth associated with dark, damp areas of ductwork. The recommended test procedure for bacterial and fungal growth is found in 21CFR 177, 1210 closures with sealing gaskets for food containers.

E. Ductmate or W.D.C.I. proprietary duct connection systems will be accepted. Duct constructed using these systems will refer to the manufacturers guidelines for sheet gauge, intermediate reinforcement size and spacing, and joint reinforcements.

F. Formed - on flanges (T.D.C./T.D.F./T-25A/T-25B) be accepted. Formed on flanges will be constructed as SMACNA T-25 flanges, whose limits are defined on page 1.36 1995 SMACNA Manual, Second Edition. No other construction pertaining to formed - on flanges will be accepted. Formed on flanges shall be accepted for use on ductwork 42" wide or less and must include the use of corners, bolts, and cleat. (Over 42", the reinforcement/joint deflection criteria no longer conform with the UMC).

G. Rectangular ductwork above the roof or outside shall be 4" water gauge construction.

2.03 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Ductmate Industries, Inc.
      b. Elgen Manufacturing.
      c. Linx Industries (formerly Lindab).
      d. McGill AirFlow LLC.
      e. MKT Metal Manufacturing.
      f. SEMCO LLC.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   1. Fabricate round ducts larger Than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.04 SOUND ATTENUATING DUCT LINING

A. Includes:
   1. All interior return ductwork.
   2. All outside air ductwork.
   3. All transfer air ductwork.
B. Duct liner shall have a flame spread of not over 25, a fuel contributed of not over 50 and a smoke developed of not over 50.
C. Liner shall be minimum 1 inch thick, 1.5 Lbs./Cu. Ft. density with a thermal conductance of .24 at 50 deg. F. mean temperature. (Conductance: BTU/Sq. Ft./F/Hr.).
D. Liner shall not spall or deteriorate at air velocities to 4000 FPM when installed in accordance with the manufacturer's recommendations.
E. Liner shall be Johns-Manville Linacoustic or approved substitute by Owens-Corning, CertainTeed, or Knauf. Observe all installation instructions.
F. Any ductwork in unconditioned spaces or outdoors shall have insulation totaling R-8.3.

2.05 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation For Interior Ductwork: G60.
   2. Galvanized Coating Designation For Exterior Ductwork: G90.
   3. Finishes for Surfaces Exposed to View: Mill phosphatized.
C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
D. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
   1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.
G. Fiberglass ductboard is not acceptable.

2.06 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
B. Water-Based Joint and Seam Sealant:
   1. Application Method: Brush on.
   2. Solids Content: Minimum 65 percent.
   3. Shore A Hardness: Minimum 20.
   4. Water resistant.

5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.07 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.01 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
C. Install ducts in maximum practical lengths.
D. Install ducts with fewest possible joints.
E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.02 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
B. Seal ducts at a minimum to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.04 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.
   2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
   4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
   5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.05 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.06 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.07 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
   1. Underground Ducts: Concrete-encased, PVC-coated, galvanized sheet steel with thicker coating on duct exterior.

B. Supply Ducts:
   1. All Supply Ductwork:
      a. Pressure Class: Positive 2-inch wg.
      b. Minimum SMACNA Seal Class: C for 0-2”; B for 3”; A for 4”,6”,10”.
      c. SMACNA Leakage Class for Rectangular: 16 for 0-2”; 8 for 3”; 4 for 4”,6”,10”.
      d. SMACNA Leakage Class for Round and Flat Oval: 8 for 0-2”; 4 for 3”; 2 for 4”,6”,10”.

C. Return Ducts:
   1. All Return Ductwork:
      a. Pressure Class: Positive or negative 1-inch wg.
      b. Minimum SMACNA Seal Class: C.
      c. SMACNA Leakage Class for Rectangular: 16.
      d. SMACNA Leakage Class for Round and Flat Oval: 8.

D. Exhaust Ducts:
   1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
      a. Pressure Class: Negative 1-inch wg.
      b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.
      c. SMACNA Leakage Class for Rectangular: 12.
      d. SMACNA Leakage Class for Round and Flat Oval: 8.
   2. All Other Return Air Ductwork:
      a. Pressure Class: Positive or negative 1-inch wg.
      b. Minimum SMACNA Seal Class: A
      c. SMACNA Leakage Class for Rectangular: 16.
      d. SMACNA Leakage Class for Round and Flat Oval: 8.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
   1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
      a. Pressure Class: Positive or negative 1-inch wg.
      b. Minimum SMACNA Seal Class: C.
      c. SMACNA Leakage Class for Rectangular: 16.
      d. SMACNA Leakage Class for Round and Flat Oval: 8.

F. Intermediate Reinforcement:
   1. Galvanized-Steel Ducts: Galvanized steel.
   2. PVC-Coated Ducts:
      a. Exposed to Airstream: Match duct material.
      b. Not Exposed to Airstream: Galvanized.
   3. Stainless-Steel Ducts:
      a. Exposed to Airstream: Match duct material.
      b. Not Exposed to Airstream: Galvanized.

4. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.

G. Elbow Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
      a. Velocity 1000 fpm or Lower:
         1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
         2) Mitered Type RE 4 without vanes.
      b. Velocity 1000 to 1500 fpm:
         1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
         2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
         3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
      c. Velocity 1500 fpm or Higher:
         1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
         2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
         3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
   2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
      a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
   3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
      a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
         1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
         2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
         3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
         4) Radius-to Diameter Ratio: 1.5.
      b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
      c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

H. Branch Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
      a. Rectangular Main to Rectangular Branch: 45-degree entry.
      b. Rectangular Main to Round Branch: Spin in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
   a. Velocity 1000 fpm or Lower: 90-degree tap.
   b. Velocity 1000 to 1500 fpm: Conical tap.
   c. Velocity 1500 fpm or Higher: 45-degree lateral.

I. General Requirements
   1. Ductwork in the pool and pool equipment room shall be aluminum construction with aluminum hangers, supports, and fasteners.
   2. Rectangular ductwork above the roof or outside shall be 4" water gauge construction.

J. Rectangular ductwork in the pool and pool equipment room shall be aluminum construction with stainless steel (317L or 904L) hangers, supports, and fasteners.
   1. All ductwork in moist areas (Toilet Rooms, locker rooms, kitchens, etc.) shall be aluminum construction with aluminum hangers, supports, and fasteners.

END OF SECTION

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Backdraft and pressure relief dampers.
   2. Manual volume dampers.
   3. Control dampers.
   4. Smoke dampers.
   5. Flange connectors.
   6. Turning vanes.
   7. Duct-mounted access doors.
   8. Flexible connectors.
   9. Duct accessory hardware.

B. Related Requirements:
   1. Section 233723 "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
   2. Section 283000 " Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
   1. Product data showing compliance with ASHRAE 62.1.
   2. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances, and method of field assembly into duct systems and other construction. Include the following:
      a. Special fittings.
      b. Manual volume damper installations.
      c. Control-damper installations.
      d. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
      e. Wiring Diagrams: For power, signal, and control wiring.

1.03 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.01 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with

NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.02 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G60 for indoor applications and G90 for exterior applications.
   2. Exposed-Surface Finish: Mill phosphatized.
B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and for exposed ducts.
C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.03 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Warming and Ventilating; a Mestek Architectural Group company.
   2. Greenheck Fan Corporation.
   3. Lloyd Industries, Inc.
   4. Nailor Industries Inc.
   5. NCA Manufacturing, Inc.
   6. Pottorff.
   7. Ruskin Company.
B. Description: Gravity balanced.
C. Maximum Air Velocity: 2500 fpm.
D. Maximum System Pressure: 2-inch wg
E. Maximum Pressure Drop Across the Damper: .2”wg
F. Frame: Hat-shaped, 0.063-inch-thick extruded aluminum or 0.05-inch- thick stainless steel, with welded corners or mechanically attached and mounting flange.
G. Blades: Multiple single-piece blades, center pivoted, maximum 6-inch width, 0.050-inch-thick aluminum sheet with sealed edges.
H. Blade Action: Parallel.
I. Blade Seals: Extruded vinyl, mechanically locked or Neoprene, mechanically locked.
J. Blade Axles:
   1. Material: Stainless steel.
   2. Diameter: 0.20 inch.
K. Tie Bars and Brackets: Galvanized steel.
L. Return Spring: Adjustable tension.
M. Bearings: Synthetic pivot bushings.
N. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Screen Mounting: Rear mounted.
4. Screen Material: Aluminum.
5. Screen Type: Insect.
6. 90-degree stops.

O. Air Leakage: Class I – Not to exceed 8 CFM/FT2 @ 4” w.g. AMCA Certified.

2.04 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Warming and Ventilating; a Mestek Architectural Group company.
   b. Flexmaster U.S.A., Inc.
   c. McGill AirFlow LLC.
   d. Nailor Industries Inc.
   e. Pottorff.
   f. Ruskin Company.
2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.
4. Frames:
   a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
   b. Mitered and welded corners.
   c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Galvanized steel, 0.064 inch thick.
6. Blade Axles: Galvanized steel.
7. Bearings:
   a. Molded synthetic.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Warming and Ventilating; a Mestek Architectural Group company.
   b. McGill AirFlow LLC.
   c. Nailor Industries Inc.
   d. Pottorff.
   e. Ruskin Company.
2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.
4. Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
   a. Multiple or single blade.

b. Parallel or opposed-blade design.
c. Stiffen damper blades for stability.
d. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
e. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.

6. Blade Axles: [Galvanized steel] [Stainless steel] [Nonferrous metal].
7. Bearings:
   a. [Oil-impregnated bronze] [Molded synthetic] [Stainless-steel sleeve].
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Aluminum.

C. Jackshaft:
1. Size: 1-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:
1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.05 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Warming and Ventilating; a Mestek Architectural Group company.
2. Arrow United Industries.
3. Greenheck Fan Corporation.
4. Lloyd Industries, Inc.
5. McGill AirFlow LLC.
6. Metal Form Manufacturing, Inc.
7. Nailor Industries Inc.
8. Pottorff.
9. Ruskin Company.
10. Tamco
11. Young Regulator Company.

B. Frames:
1. Hat, U, or Angle shaped.
2. 0.05-inch thick stainless steel.
3. Mitered and welded corners.

C. Blades:
1. Multiple blade with maximum blade width of 6 inches.
2. Opposed blade design.
3. Aluminum.
4. 0.0747-inch- thick dual skin.
5. Blade Edging: Closed-cell neoprene.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

D. Blade Axles: 1/2-inch-diameter; nonferrous metal; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg. F.

E. Bearings:
   1. Molded synthetic.
   2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
   3. Thrust bearings at each end of every blade.

F. Air Leakage: Class I – Not to exceed 8 CFM/FT2 @ 4”w.g.. AMCA Certified.

2.06 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Warming and Ventilating; a Mestek Architectural Group company.
   2. Greenheck Fan Corporation.
   3. Nailor Industries Inc.
   4. Pottorff.
   5. Ruskin Company.

B. General Requirements: Label according to UL 555S by an NRTL.

C. Smoke Detector: Shall be provided by the Fire Alarm Contractor / Electrical Contractor and installed by the Mechanical Contractor.

D. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, with interlocking, gusseted or mechanically attached corners and mounting flange.

E. Blades: Roll-formed, horizontal, interlocking, 0.063-inch thick, galvanized sheet steel.

F. Leakage: Class I.

G. Rated pressure and velocity to exceed design airflow conditions.

H. Mounting Sleeve: Factory-installed, 0.05-inch thick, galvanized sheet steel; length to suit wall or floor application [with factory-furnished silicone caulking].

I. Damper Motors: two-position action.

J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
   1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
   2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."
   3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
   4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
   5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg. F.
   6. Nonspring-Return Motors: For damper’s larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
   7. Electrical Connection: 24 V.

K. Accessories:

1. Auxiliary switches for [signaling] [fan control] [or] [position indication]. [Momentary test switch] [Test and reset switches], [damper] [remote] mounted.

2.07 COMBINATION SMOKE/FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Warming and Ventilating; a Mestek Architectural Group company.
   2. Greenheck Fan Corporation.
   3. Nailor Industries Inc.
   4. Pottorff.
   5. Ruskin Company.
B. General Requirements:
   1. Dampers shall be furnished with both the 1 1/2 hour (or 3 hour) UL label for fire dampers - UL 555 and the UL label for leakage resistance (smoke) - UL 555S.
   2. Refer to the requirements of Fire Dampers and Smoke Dampers for additional requirements.

2.08 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ductmate Industries, Inc.
B. Description: Roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
C. Material: Galvanized steel.
D. Gage and Shape: Match connecting ductwork.

2.09 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Aero-Dyne Sound Control Co.
   2. Ductmate Industries, Inc.
   3. Duro Dyne Inc.
   4. Elgen Manufacturing.
   5. Hardcast, Inc.
   6. METALAIRE, Inc.
   7. SEMCO LLC.
B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
   1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
E. Vane Construction: Double wall.

2.10 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Warming and Ventilating; a Mestek Architectural Group company.
   2. Ductmate Industries, Inc.
   3. Elgen Manufacturing.
   4. Flexmaster U.S.A., Inc.
   5. Greenheck Fan Corporation.
   6. McGill AirFlow LLC.
   7. Nailor Industries Inc.
   8. Pottorff.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
   1. Door:
      a. Double wall, rectangular.
      b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
      c. Vision panel.
      d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
      e. Fabricate doors airtight and suitable for duct pressure class.
   2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
   3. Number of Hinges and Locks:
      a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
      b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
      c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches with outside handles.
      d. Access Doors Larger Than 24 by 48 Inches: Continuous and two compression latches with outside handles.

2.11 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. 3M.
   2. Ductmate Industries, Inc.
   3. Flame Gard, Inc.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0428-inch stainless steel.

D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg. F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.12 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Elgen Manufacturing.
3. Hardcast, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5 ¾ inches wide attached to two strips of 2 ¾ -inch-wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg. F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
1. Minimum Weight: 24 oz./sq. yd.
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg. F.

2.13 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.14 ABOVE THE ROOF DUCT CURBS

A. Furnish and install - RPS Duct Mounting Pedestals as manufactured by RPS Products and Systems Corp., Bensenville, IL at all necessary specified points or as shown on drawings. The duct mounting pedestal shall include an equipment rail, a matching length steel slide channel attached to "U" shaped mounting brackets and secured to side of equipment rail with lag bolts. The duct mounting assembly shall have galvanized 18' long continuous threaded rods for 12" vertical adjustment, lateral adjust spacer bracket for 12" horizontal adjustment, and galvanized slide assembly.

2.15 VOLUME DAMPER CONTROL - REMOTE EXTERNAL CONTROL

Applications: Drywall ceilings or where shown on drawings.
1. Location: In ductwork where required to control air flow or balance air systems.
2. Volume Damper Type: Opposed single blade round butterfly damper for external control, EPDM low leakage seals, scoop and spin-in type shell, Young Regulator Co. 5020 CC Series. Rectangular: #830-CC Series.
3. Leakage:10 CFM maximum at 4” s.p. for 4 square dampers.
4. Material: Galvanized steel in galvanized steel ductwork, extruded aluminum in aluminum ductwork.
5. Controls: Bowden Cable Control Kit 270-896C to include hardware, for ceiling mounting in conjunction with external control of round or rectangular dampers, flush 7/8” diameter cold rolled steel cover is zinc plated for painting, 12” wrench (damper adjustments), metal clad control cable.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
C. Install backdraft or control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
    1. Install steel volume dampers in steel ducts.
    2. Install aluminum volume dampers in aluminum ducts.
E. Set dampers to fully open position before testing, adjusting, and balancing.
F. Install test holes at fan inlets and outlets and elsewhere as indicated.
G. Install fire and smoke dampers according to UL listing.
H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
    1. On both sides of duct coils.
    2. Upstream from duct filters.
    3. At outdoor-air intakes and mixed-air plenums.
    4. At drain pans and seals.
    5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
    6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
    7. At each change in direction and at maximum 50-foot spacing.
    8. Upstream from turning vanes.
    9. Upstream or downstream from duct silencers.
    10. Control devices requiring inspection.
    11. Elsewhere as indicated.
I. Install access doors with swing against duct static pressure.
J. Access Door Sizes:
    1. One-Hand or Inspection Access: 8 by 5 inches.
    2. Two-Hand Access: 12 by 6 inches.
    3. Head and Hand Access: 18 by 10 inches.
    4. Head and Shoulders Access: 21 by 14 inches.
    5. Body Access: 25 by 14 inches.
    6. Body plus Ladder Access: 25 by 17 inches.
K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
L. Install flexible connectors to connect ducts to equipment.

M. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
N. Connect diffusers or light troffer boots to ducts with maximum 10 feet lengths of flexible duct clamped or strapped in place.
O. Connect flexible ducts to metal ducts with draw bands.
P. Install duct test holes where required for testing and balancing purposes.
Q. Install volume damper control – remote external control when balancing dampers are located above in accessible ceilings similar to gypsum board.

3.02 FIELD QUALITY CONTROL

A. Tests and Inspections:
1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.

END OF SECTION

SECTION 23 33 46 - FLEXIBLE DUCTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Insulated supply flexible ducts.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Sustainable Design Submittals:
   1. Product data showing compliance with ASHRAE 62.1.
   2. Product Data: For adhesives and sealants, indicating VOC content.
   3. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.
   4. Laboratory Test Reports: For Insulation, indicating compliance with requirements for low-emitting materials.
   5. Product Data: For insulation, indicating that R-values comply with tables in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air Conditioning."
C. Shop Drawings: For flexible ducts.
   1. Include plans showing locations and mounting and attachment details.

1.03 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.

PART 2 - PRODUCTS

2.01 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."
D. Comply with ASTM E 96/E 96M, "Test Methods for Water Vapor Transmission of Materials."

2.02 INSULATED FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the

following:
1. Atco
2. Flexmaster U.S.A., Inc.
3. Flex-Tek Group.
4. McGill AirFlow LLC.
5. Thermaflex.
6. Ward Industries; a brand of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene [aluminized] vapor-barrier film.
1. Pressure Rating: 10-inch wg positive and 10-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 210 deg. F.
4. Insulation R-Value: Comply with ASHRAE/IES 90.1 - R4.2 in conditioned space, R8.0 in unconditioned space/outdoors.
5. Comply with 25/50 flame spread and smoke density ratings.

2.03 FLEXIBLE DUCT CONNECTORS

A. Clamps: Nylon strap in sizes 3 through 18 inches, to suit duct size.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install flexible ducts according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
B. Applies to supply ductwork only. Exhaust and return ductwork to be rigid ductwork.
C. Flexible air connectors and flexible ducts shall not be used to make 90 degree or greater.
D. Install in indoor applications only. Flexible ductwork should not be exposed to UV lighting.
E. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
F. Connect diffusers or light troffer boots to ducts with maximum 10’-0” lengths of flexible duct clamped or strapped in place.
G. Connect flexible ducts to metal ducts with liquid adhesive plus tape.
H. Install duct test holes where required for testing and balancing purposes.
I. Installation:
1. Install ducts fully extended.
2. Do not bend ducts across sharp corners.
3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
5. Install flexible ducts in a direct line, without sags, twists, or turns.

J. Supporting Flexible Ducts:
1. Suspend flexible ducts with bands 1 ½ inches wide or wider and spaced a maximum of 48 inches apart. Maximum centerline sag between supports shall not exceed 1/2 inch per 12 inches.

2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.
3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.
4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 inches o.c.

END OF SECTION

SECTION 23 37 13.13 - AIR DIFFUSERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Rectangular and square ceiling diffusers.
   2. Perforated diffusers.
   3. Louver face diffusers.
   4. Air Filters
B. Related Requirements:
   1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
   2. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.
   3. The SMACNA Low Velocity Duct Manual, ASHRAE Handbooks, International Mechanical Code, and NFPA Pamphlet 90A shall apply to this work.
   4. Refer to Section 233113 “Metal Ductwork.

1.02 WORK INCLUDED

A. Provide labor, material, equipment, and supervision necessary to install a complete air handling system with all supply and return distribution devices as indicated on the drawings and specified herein.
B. Contractor is to furnish and install a volume damper in all supply, return, exhaust, and outside air branch ductwork. If these are omitted from the drawings, the contractor is to make an allowance to install one.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Submit manufacturer’s literature and performance data of equipment and devices for review.
C. Samples; Furnish at request of A/E.

1.04 QUALITY ASSURANCE

A. Verify that all equipment is installed in accordance with manufacturer’s warranty requirements.
B. Provide adequate supervision of labor force to see that installations are correct.

PART 2 - PRODUCTS

2.01 RECTANGULAR AND SQUARE CEILING DIFFUSERS

A. Furnish and install terminal air diffusers of the size and capacity indicated on the drawings.
B. Room terminal air velocity shall not exceed 50 fpm. NC level shall not exceed 40. Air static pressure drop shall not exceed 0.10" wg.
C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    1. Anemostat
    2. Carnes Company.
    3. Hart & Cooley Inc.
    4. Krueger.
    5. METALAIRE, Inc.
    6. Nailor Industries Inc.
    7. Price Industries.
    8. Titus.
    9. Tuttle & Bailey.
D. Devices shall be specifically designed for variable-air-volume flows.
E. Material: Steel. Shall be aluminum if located in a damp area similar to a commercial kitchen, locker room, residential bathrooms.
F. Finish: Baked enamel, white
G. Face Size: 12 by 12 inches for up to 150 cfm, 24 by 24 inches for all other size.
H. Face Style: Three cone or Plaque.
I. Mounting: Each diffuser shall have a mounting flange specifically selected for the particular type of ceiling finish. Contractor to coordinate with architectural ceiling details.
J. Pattern: Fixed
K. Dampers: Radial opposed blade
L. Accessories:
    1. Equalizing grid.
    2. Plaster ring.
    3. Safety chain.
    4. Wire guard.
    5. Sectorizing baffles.
    6. Operating rod extension.
M. Performance shall be tested in accordance with ASHRAE 70-2006 (RA 2011).

2.02 LOUVER FACE DIFFUSERS

A. Furnish and install terminal air diffusers of the size and capacity indicated on the drawings.
B. Room terminal air velocity shall not exceed 50 fpm. NC level shall not exceed 40. Air static pressure drop shall not exceed 0.10" wg
C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    1. Anemostat
    2. Carnes Company.
    3. METALAIRE, Inc.
    4. Nailor Industries Inc.
    5. Price Industries.
    6. Titus.
    7. Tuttle & Bailey.
D. Devices shall be specifically designed for variable-air-volume flows.
E. Material: Steel. Shall be aluminum if located in a damp area similar to a commercial kitchen, locker room, residential bathrooms.

F. Finish: Baked enamel, white
G. Face Size: 24” x 24”
H. Mounting: Each diffuser shall have a mounting flange specifically selected for the particular type of ceiling finish. Contractor to coordinate with architectural ceiling details.
I. Pattern: Fixed
J. Pattern: One-way, Two-way, Two-way corner, Three-way or Four-way core style.
K. Dampers: Radial opposed blade
L. Accessories:
   1. Square to round neck adaptor.
   2. Adjustable pattern vanes.
   3. Throw reducing vanes.
   4. Equalizing grid.
   5. Plaster ring.
   6. Safety chain.
   7. Wire guard.
   8. Sectorizing baffles.
   9. Operating rod extension.
M. Performance shall be tested in accordance with ASHRAE 70-2006 (RA 2011).

2.03 AIR FILTERS

A. Refer to drawings and schedules for certain air filtration requirements for various systems.
B. These filters are to be installed in air handling equipment if the equipment is capable of receiving them. If not, the contractor shall install the filters in a filter frame with gasketed doors on the entering side of the unit. The filter frame in either case shall provide an airtight fit with gaskets.
C. Furnish and install a red oil manometer for each filter of efficiency of 30 percent or more and with a range of 0 to 30 inches water gage. Gauge to be Dwyer Instruments, Inc.
D. The filter shall meet a minimum of MERV (xx) @ 2000 cfm (500 fpm) per ASHRAE Standard 52.2-2007 and shall be required to meet the same MERV-A value when tested per “Appendix j” of the aforementioned Standard. A filter with a MERV -A value lower than the MERV rating is not acceptable.
E. Manufacturers: CAMFIL/FARR Co., ECO Air Filters, Flanders, American Air Filter.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install diffusers level and plumb.
B. Supports: Galvanized steel per SMACNA.
C. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
D. Install diffusers with airtight connections to ducts and to allow service and maintenance of

dampers, air extractors, and fire dampers.

3.02 ADJUSTING

A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

3.03 FILTERS

A. All filters shall be clean prior to acceptance by the owner. Renewable media filters shall be replaced with new filters. Cleanable filters shall be removed and cleaned just prior to acceptance.
B. Provide one spare set of replaceable filters for each system to the owner prior to acceptance of the work.

3.04 CEILING OPENING PROTECTION

A. Each supply, return, and exhaust opening in a ceiling shall be protected in accordance with UL Laboratories for the integrity of the fire stopping rating. This will require that each opening be suitably protected throughout the building.
B. Dampers shall bear the U.L. Label and shall be installed in accordance with the U.L. Standards and manufacturer's instructions.
C. A ceramic blanket shall be attached to diffuser neck and duct using steel duct clamp or 16 ga. Steel wire. Blanket shall be supported from 4 corners using 12 swg wire.

END OF SECTION

SECTION 23 37 13.23 - REGISTERS AND GRILLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Adjustable blade face registers and grilles.
   2. Fixed face registers and grilles.
B. Related Requirements:
   1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
   2. Section 233713.13 "Air Diffusers" for various types of air diffusers.
   3. The SMACNA Low Velocity Duct Manual, ASHRAE Handbooks, International Mechanical Code, and NFPA Pamphlet 90A shall apply to this work.
   4. Refer to Section 233113 “Metal Ductwork”.

1.02 WORK INCLUDED

A. Provide labor, material, equipment, and supervision necessary to install a complete air handling system with all supply and return distribution devices as indicated on the drawings and specified herein.
B. Contractor is to furnish and install a volume damper in all supply, return, exhaust, and outside air branch ductwork. If these are omitted from the drawings, the contractor is to make an allowance to install one.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Submit manufacturer’s literature and performance data of equipment and devices for review.
C. Samples; Furnish at request of A/E.

1.04 QUALITY ASSURANCE

A. Verify that all equipment is installed in accordance with manufacturer’s warranty requirements.
B. Provide adequate supervision of labor force to see that installations are correct.

PART 2 - PRODUCTS

2.01 REGISTERS

A. Furnish and install terminal air registers of the size and capacities indicated on the drawings.
B. Adjustable Blade Face Register:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of

the following:
a. Anemostat Products; a Mestek company.
b. Carnes Company.
c. Krueger.
d. METALAIRE, Inc.
e. Nailor Industries Inc.
f. Price Industries.
g. Titus.
h. Tuttle & Bailey.

2. Material: Steel. Shall be aluminum if located in a damp area similar to a commercial kitchen, locker room, residential bathrooms.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal, spaced -1/2 inch centers for return and exhaust and 3/4 inch centers for supply, single set at 45 degrees for return or exhaust and double deflection adjustable for supply. Reinforced corners, mitered.
5. Core Construction: Removable.
6. Rear-Blade Arrangement: Vertical, spaced 1/2 inch centers for return and exhaust and 3/4 inch centers for supply.
7. Frame: 1 inch wide.
8. Mounting Frame: Provide separable frames in drywall, plaster, or masonry construction as noted on the architectural drawings.
9. Mounting: Countersunk screw
10. Damper Type: Adjustable opposed blade

C. Fixed Face Register
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Anemostat Products; a Mestek company.
b. Carnes Company.
c. Krueger.
d. Nailor Industries Inc.
e. Price Industries.
f. Titus.
g. Tuttle & Bailey.
2. Material: Steel. Shall be aluminum if located in a damp area similar to a commercial kitchen, locker room, residential bathrooms.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal, spaced 1/2 inch centers for return and exhaust and 3/4 inch centers for supply, single set at 45 degrees for return or exhaust and double deflection adjustable for supply. Reinforced corners, mitered.
5. Face Arrangement: Perforated core.
6. Core Construction: Removable.
7. Frame: 1 inch wide.
8. Mounting Frame: Provide separable frames in drywall, plaster, or masonry construction as noted on the architectural drawings.
9. Mounting: Countersunk screw
10. Damper Type: Adjustable opposed blade
11. Accessory: Filter.

D. Furnish and install turning vanes for connections to ducts.
E. Where registers are located low near floor, they shall be heavy duty 14 gauge steel with fixed 45 degree blades on 1/2" centers. In damp areas, they shall be extruded aluminum.

F. Where drawings indicate linear return grilles, they shall be linear extruded aluminum with 1/8" bars 3/4" long on 1/4" centers.

2.02 GRILLES

A. Furnish and install terminal air registers of the size and capacities indicated on the drawings.
B. Adjustable Blade Face Grille:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Anemostat Products; a Mestek company.
      b. Carnes Company.
      c. Krueger.
      d. METALAIRE, Inc.
      e. Nailor Industries Inc.
      f. Price Industries.
      g. Titus.
      h. Tuttle & Bailey.
   2. Material: Steel. Shall be aluminum if located in a damp area similar to a commercial kitchen, locker room, residential bathrooms.
   3. Finish: Baked enamel, white.
   4. Face Blade Arrangement: Horizontal spaced 1/2 inch apart.
   5. Core Construction: Removable.
   6. Rear-Blade Arrangement: Horizontal, spaced 1/2 inch centers for return and exhaust and 3/4 inch centers for supply, single set at 45 degrees for return or exhaust and double deflection adjustable for supply. Reinforced corners, mitered.
   7. Frame: 1 inch.
   8. Mounting Frame: Provide separable frames in drywall, plaster, or masonry construction as noted on the architectural drawings.
   9. Mounting: Countersunk screw.
   10. Accessories:
      a. Filter.
C. Fixed Face Grille
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Anemostat Products; a Mestek company.
      b. Carnes Company.
      c. Krueger.
      d. Nailor Industries Inc.
      e. Price Industries.
      f. Titus.
      g. Tuttle & Bailey.
   2. Material: Steel. Shall be aluminum if located in a damp area similar to a commercial kitchen, locker room, residential bathrooms.
   3. Finish: Baked enamel, white
   4. Face Blade Arrangement: Horizontal, spaced 1/2 inch centers for return and exhaust and 3/4 inch centers for supply, single set at 45 degrees for return or exhaust and double deflection adjustable for supply. Reinforced corners, mitered.
   5. Face Arrangement: Perforated core.
   6. Core Construction: Removable.
   7. Frame: 1 inch

8. Mounting Frame: Provide separable frames in drywall, plaster, or masonry construction as noted on the architectural drawings.
9. Mounting: Countersunk screw.
10. Accessory: Filter.

D. Furnish and install turning vanes for connections to ducts.
E. Where registers are located low near floor, they shall be heavy duty 14 gauge steel with fixed 45 degree blades on 1/2" centers. In damp areas, they shall be extruded aluminum.
F. Where drawings indicate linear return grilles, they shall be linear extruded aluminum with 1/8" bars 3/4" long on 1/4" centers.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install registers and grilles level and plumb.
B. Supports: Galvanized steel per SMACNA.
C. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
D. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.02 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 23 74 16.13 - PACKAGED, MID-CAPACITY, GAS FIRED ROOFTOP UNITS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes packaged, large-capacity, rooftop air conditioning units (RTUs) with the following components and accessories:
   1. Casings.
   2. Fans.
   3. Motors.
   4. Coils.
   5. Refrigerant circuit components.
   6. Air filtration.
   7. Supported bag filters.
   8. Gas furnaces.
   9. Dampers.
   10. Electrical power connections.
   11. Controls.
   12. Accessories
   13. Roof curbs.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Sustainable Design Submittals:
   1. Product Data: For adhesives, mastics, and sealants, indicating VOC content.
   2. Laboratory Test Reports: For adhesives, mastics, and sealants, indicating compliance with requirements for low-emitting materials.
   3. Product Data: For energy performance.
   4. Product Data: For ventilation equipment, indicating compliance with ASHRAE 62.1, Section 5 - "Systems and Equipment."
   5. Product Data: For air filtration performance.
C. Shop Drawings:
   1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Include diagrams for power, signal, and control wiring.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.
B. Sample warranty.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.05 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of RTUs that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
   2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion.
   3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
   4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. AHRI Compliance:
   1. Comply with AHRI 340/360 for testing and rating energy efficiencies for RTUs.
   2. Comply with AHRI 270 / 370 for testing and rating sound performance for RTUs.
   3. Comply with AHRI 210/240 for testing and rating energy efficiencies for RTUs.

B. AMCA Compliance:
   1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
   2. Damper leakage tested in accordance with AMCA 500-D.
   3. Operating Limits: Classify according to AMCA 99.

C. ASHRAE Compliance:
   1. Comply with ASHRAE 15 for refrigeration system safety.
   2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
   3. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

E. NFPA Compliance: Comply with NFPA 90A or NFPA 90B.

F. UL Compliance: Comply with UL 1995.

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Daikin Applied.
   2. Lennox Industries, Inc.; Lennox International.
   3. Trane
   4. YORK; a Johnson Controls company.

2.03 PERFORMANCE REQUIREMENTS

A. Refer to mechanical schedules.

2.04 CAPACITIES AND CHARACTERISTICS

A. Refer to drawings for performance requirements.

2.05 CASINGS

A. General Fabrication Requirements for Casings: Formed and reinforced insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
B. Single Wall Construction.
C. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
    1. Corrosion Protection: 1,000 hours salt spray test in accordance with ASTM B117.
D. Inner Casing Fabrication Requirements:
    1. Inside Casing: G-90-coated galvanized steel, 0.028 inch thick.
E. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
    1. Materials: ASTM C 1071, Type I.
    2. Thickness: 1/2 inch.
    3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
    4. Liner Adhesive: Comply with ASTM C 916, Type I.
F. Condensate Drain Pans: Fabricated using stainless steel, a minimum of 2 inches deep, and complying with ASHRAE 62.1 for design and construction of drain pans.
    1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
    2. Drain Connections: Threaded nipple.
G. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.06 FANS

A. Supply-Air Fans: Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.
    1. Forward curved, double width, double inlet, centrifugal type fan.
    2. Belt-Driven Supply-Air Fans: Motors shall be installed on an adjustable fan base resiliently mounted in the casing.
B. Condenser-Coil Fan: Direct drive propeller, mounted on shaft of permanently lubricated motors.
C. Relief-Air Fan: Propeller Forward curved Backward inclined, shaft mounted on permanently lubricated motor.

2.07 MOTORS

A. Comply with NEMA MG 1, Design B, medium induction motor, unless otherwise indicated.
B. Comply with IEEE 841 for severe-duty motors.

C. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
D. Duty: Continuous duty at ambient temperature of 104 deg. F and at altitude of 3300 feet above sea level.
E. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
F. Efficiency: Energy efficient, as defined in NEMA MG 1.
G. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements.
H. Multispeed Motors: Variable torque.
    1. For motors with 2:1 speed ratio, consequent pole, single winding.
    2. For motors with other than 2:1 speed ratio, separate winding for each speed.
I. Multispeed Motors: Separate winding for each speed.
J. Rotor: Random-wound, squirrel cage.
K. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
L. Temperature Rise: Match insulation rating.
M. Insulation: Class F.
N. Code Letter Designation:
    1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
    2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
O. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.
P. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
Q. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
    1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
    2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
    3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
    4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.08 COILS

A. Supply-Air Refrigerant Coil:
    1. Aluminum-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
    2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
    3. Coil Split: Interlaced.
    4. Condensate Drain Pan: Galvanized steel with corrosion-resistant coating formed with pitch and drain connections.
B. Outdoor-Air Refrigerant Coil:
    1. Aluminum plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.

2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.

2.09 REFRIGERANT CIRCUIT COMPONENTS

A. Number of Refrigerant Circuits: Two.
B. Compressor: Hermetic, direct drive scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.
C. Refrigeration Specialties:
   1. Refrigerant: R-410A.
   2. Expansion valve with replaceable thermostatic element.
   3. Refrigerant filter/dryer.
   4. Manual-reset high-pressure safety switch.
   5. Automatic-reset low-pressure safety switch.
   6. Minimum off-time relay.
   7. 7Automatic-reset compressor motor thermal overload.
   8. Brass service valves installed in compressor suction and liquid lines.
   9. Units shall have cooling capabilities down to 0 degree F as standard. For field-installed low ambient accessory, the manufacturer shall provide a factory-authorized service technician that will assure proper installation and operation.
   10. Variable Speed Compressors
      a. Variable speed compressor shall be capable of speed modulation from 15Hz to a maximum of 75Hz. The minimum unit capacity shall be 25% of full load or less.
      b. The compressor motor shall be permanent magnet type.
      c. Each variable speed compressor shall be matched with a specifically designed, refrigerant cooled, variable frequency drive which modulates the speed of the compressor motor and provides several compressor protection functions.
      d. Control of the variable speed compressor and inverter control, as well as tandem direct driver, scroll type compressors shall be integrated with the controller to ensure optimal equipment reliability and efficiency.
      e. Each compressor shall have a crankcase heater as standard.

2.10 AIR FILTRATION

A. Minimum arrestance and MERV according to ASHRAE 52.2 2007 and shall be required to meet the same MERV-A value when tested per “Appendix j” of the aforementioned Standard. A filter with a MERV -A value lower than the MERV rating is not acceptable.

2.11 GAS FURNACES

A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.
   1. CSA Approval: Designed and certified by and bearing label of CSA.
B. Burners: Stainless steel.
   1. Fuel: Natural gas.
   2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.
C. Heat-Exchanger and Drain Pan: Stainless steel.

D. Venting: Gravity vented with vertical extension.
E. Power Vent: Integral, motorized centrifugal fan interlocked with gas valve with vertical extension.
F. Safety Controls:
   1. Gas Control Valve: Modulating.
   2. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

2.12 DAMPERS

A. Outdoor- and Return-Air Mixing Dampers: Opposed blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage or gears and interconnect so dampers operate simultaneously.
   1. Leakage Rate: As required by ASHRAE/IES 90.1.
   2. Damper Motor: Modulating with adjustable minimum position.
   3. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IES 90.1, with bird screen and hood.

2.13 ELECTRICAL POWER CONNECTIONS

A. RTU shall have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.14 CONTROLS

A. Control equipment and sequence of operation are specified in Section 230933 “Automatic Temperature Control”

   Basic Unit Controls:
   1. Control-voltage transformer.
   2. Wall-mounted thermostat with the following features:
      a. Heat-cool-off switch.
      b. Fan on-auto switch.
      c. Fan-speed switch.
      d. Automatic changeover.
      e. Adjustable deadband.
B. Electronic Controller:
   1. Controller shall have volatile-memory backup.
   2. Safety Control Operation:
      a. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire-alarm control panel.
      b. Fire-Alarm Control Panel Interface: Provide control interface to the fire alarm system.
   3. Scheduled Operation: Occupied and unoccupied periods on 365-day clock with a minimum of two programmable periods per day.
   4. Refer to the control specification section for the sequence of operation.

2.15 ACCESSORIES

A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.
B. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.
C. Factory- or field-installed, demand-controlled ventilation.
D. Safeties:
    1. Smoke detector - Smoke detector shall be factory installed photoelectric smoke detector mounted in the return air section and/or supply air fan compartment.
    2. Condensate overflow switch.
    3. Phase-loss reversal protection.
    4. High and low pressure control.
    5. Gas furnace airflow-proving switch.
E. Hail guards of galvanized steel, painted to match casing.
F. Door switches to disable heating or reset set point when open.
G. Outdoor-air intake weather hood.
H. Provide a fully integrated 100% modulating outside air economizer with unit return and barometric relief air dampers, minimum position setting, preset linkage, wiring harness with plug. Unit operation is through primary temperature controls that automatically modulate dampers to maintain space temperature conditions. Economizer shall be dual enthalpy control.
I. Economizer Power Exhaust – Factory supplied, field installed power exhaust assembly.
J. Dehumidification / Hot Gas Reheat - Unit shall be equipped with internally finned, 5/16” copper tubes. The coil shall be 2 rows with a minimum of 16 fins per inch. Dehumidification shall be achieved by routing hot refrigerant gas from the discharge line of the compressor through the reheat coil.
K. Single Zone VAV
    1. Unit shall be provided with VFD (Variable Frequency Drive) on Indoor fan motor. VFD shall change fan speed according to mode of operation. During cooling mode, fan shall modulate to maintain space temperature. the compressor shall operate to control discharge air temperature. This operation shall be standard with SZVAV offering. During heating operation, single zone control will be allowed with modulating gas heat only. All other heat operations shall be as constant volume heating control.
    2. Unit shall be provided with optional shaft grounding rings for electrical protection. Shaft grounding rings provide long term motor/VFD bearing reliability.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.
B. Any equipment mars, blemishes, scratches, abrasions, or other surface imperfections shall be sanded, primed, and refinished to match adjacent surfaces.
C. No equipment will be accepted by the owner which has rust, corrosion, or otherwise in progress.

D. Equipment shall not be used for temporary heat unless separately negotiated with the owner.
E. All filters shall be new at time of acceptance by the owner.
F. All bare ferrous metal shall be painted prior to acceptance.
G. Equipment shall be in perfect working order prior to acceptance.
H. Furnish and install all controls and control wiring. Wiring shall be in accordance with the NEC. Control wiring above the roof shall be in galvanized steel conduit with watertight fittings.

3.02 CONNECTIONS

A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
B. Install piping adjacent to RTUs to allow service and maintenance.
   1. Gas Piping: Comply with applicable requirements in Section 231123 "Facility Natural-Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.
C. Duct installation requirements are specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
   1. Install ducts to termination at top of roof curb.
   2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
   3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
   4. Install return-air duct continuously through roof structure.

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
   2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
C. RTU will be considered defective if it does not pass tests and inspections.
D. Prepare test and inspection reports.

3.04 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION

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DIVISION 26 - ELECTRICAL

SECTION 26 00 00 - STANDARD CONDITIONS FOR ELECTRICAL WORK

PART 1 - GENERAL

1.01 REGULATIONS, CODES, STANDARDS

A. Reference Codes, applicable sections of the following codes and standards shall be considered as binding to the work of this project:

NEMA	National Electrical Manufacturers' Association
NEC	National Electrical Code (NFPA 70) - 2017 Edition
NECA	National Electrical Contractors' Association
NEIS	National Electrical Installation Standards
EGSA	Electrical Generating Systems Association
IBC	International Building Code
NFPA	National Fire Protection Association
IEEE	Institute of Electrical and Electronics Engineers
UL	Underwriter's Laboratories, Inc.
IES	Illuminating Engineering Society
OSHA	Occupational Safety and Health Administration
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
FM	Factory Mutual
IRI	Industrial Risk Insurers
ISO	Insuring Services Office
IPCEA	Insulated Power Cable Engineers Assoc.
ADA	Americans with Disability Act
NETA	International Electrical Testing Association

B. All local codes are to be incorporated.
C. The latest adopted codes and latest editions of standards shall be the basis of conformance.
D. Obtain and pay for all permits and inspections, and any associated charges.
E. Inspection Agency Certificate of Inspection to be provided at completion of the work. Inspection by Middle Department Inspection Agency, Inc., or other local inspection agency.
F. Drawings, Contract, General Conditions and Supplementary Conditions form a part of this section by reference thereto and shall have the same force and effect as if printed herewith in full. Failure to review these sections shall not relieve the Contractor of his responsibility to fully comply with the terms therein.
G. Where the contract documents are more stringent but not in conflict with the applicable codes, the more stringent requirements shall be followed.

1.02 SUBMITTALS

A. The procedure for submissions of shop drawings shall be as specified in Division 1, or as a minimum, as indicated below.
B. Furnish submissions of shop drawings and samples of materials and equipment as indicated in these sections, on the drawings, or as directed by the architect/ engineer. Submissions will

be made in a timely fashion such that adequate time exists to review the drawings or material, and arrive at the site in accordance with the project schedule.

C. Submissions will not be accepted with work defined as "By Others". Identify contractor by name and with his approval so indicated. Submissions are required prior to purchasing, fabrication, or installation of any material or equipment. Submissions shall be reviewed and certified by the submitting contractor that they are in accordance with the project documents.

D. When requested by the engineer, shop drawings shall be required to be submitted to designated agencies for review and approval prior to submission to the engineer.

E. Contractor shall arrange and pay for all tests and inspections specified herein or required by above agencies and furnish required certificate of inspection to owner.

F. Contractor shall provide performance test data and wiring diagrams of all electrical equipment.

G. Submissions shall include warrantees by the manufacturer for equipment being provided. Submissions for commonly related items such as fixtures, trim, carriers, shall be combined in a single brochure clearly identifying all items being furnished.

H. Shop drawings and submittals shall be checked and stamped by the contractor before submitting. They shall conform to measurements made at the site, the contract requirements, and shall be coordinated with all other trades.

I. Specific models in catalog sheets must be identified as well as all options, voltages, phases, etc. identified to be clear as to what is being provided.

J. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/ travel/ access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.

K. To aid in the preparation of submittals or shop drawings, the engineer can provide the electronic files for use by the contractor. The electronic files will be provided upon execution of the engineer’s electronic file release contract prepared specifically for this project. The electronic files will be released in the format used by the architect and engineer to design the project. If this file format is not compatible with the contractor’s needs, additional charges for providing the changes to the requested file format may be necessary at $150.00 per hour billable to the contractor.

1.03 SUBSTITUTIONS

A. Substitution of other than specified manufacturers shall not be allowed after bid date.

B. Prior approval is required for other manufacturers. If the contractor wishes for alternate materials or equipment to be considered, he must submit information at least ten days prior to the bid date. If acceptable, an addendum will be issued allowing the contractor to utilize the approved alternate.

C. Samples shall be provided when directed by the architect or engineer.

D. If the contractor submits alternate equipment, manufacturers, systems, methods, or materials not specifically identified in the specifications, additional review and investigation time may be required by the engineer. If the engineer determines additional review time is required because of the substitution, then this will be a billable service provided by the engineer at the rate of $150.00 per hour. Also billable will be any redesign time and revisions to drawings should they be necessary for incorporation into the work. Services will be billable to the contractor making such substitutions and will be payable prior to approval, or rejection.

E. If the contractor elects to submit alternate equipment, manufacturers, systems, methods, or materials, not specifically identified in the drawings and specifications, it is the contractor's responsibility to coordinate the work with other trades and pay for any associated costs with the substitution or change.
F. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials and equipment in manufacturer's original cartons or on skids.
B. Store materials in dry enclosure out of way of work progress.
C. Protect equipment, fixtures, and lenses after placement.

1.05 REFERENCE

A. Requirements established within the portions of this Project Manual titled Division 1, General Requirements are collectively applicable to the work of this section.
B. Instructions to Bidders, Special Conditions and Addenda as issued are part of this specification.
C. Electrical drawings along with all other project drawings represent the work of this Division.
D. Drawings, Contract, General Conditions and Supplementary Conditions form a part of this section,
by reference thereto and shall have the same force and effect as if printed herewith in full. Failure to review these sections shall not relieve the Contractor of his responsibility to fully comply with the terms therein.

1.06 WORK SUMMARY

A. Provide labor, materials, equipment, and supervision necessary to install complete, operating electrical systems as indicated on the drawings and specified herein, including all work at the site and within the proposed construction areas to accomplish the require work.
B. Contractor shall provide all demolition necessary to remove, replace, repair, install new or modify existing work whether it be walls, floors, ceilings, structure, mechanical or electrical required to install his work. Contractor shall replace all work to leave in a finished condition. Pipe, conduit, ductwork, and wiring shall be cut back behind wall surfaces above ceilings and below floor levels so that a patch can be placed over the opening.
C. Demolition:
    1. Electrical contractor shall verify all existing conditions prior to commencing work.
    2. Remove branch circuits back to the power source or the nearest device to remain active. Restore all circuits interrupted by the demolition work to maintain circuit continuity.
    3. Label all overcurrent protection devices made "spare" due to demolition. Update all panelboard directories impacted by the demolition.
    4. Relocate existing branch circuits which interfere with new construction whether specifically identified or not. Refer to architectural drawings for new walls, structure,

millwork, etc. which may require existing conduit, wire, etc. to be relocated.

5. It is the intent that power remain active in adjacent areas during the construction. Contractor is to modify existing wiring arrangement to comply.
6. All equipment and appurtenances removed are to be disposed of properly. Refer to local, state, and federal requirements.

D. All work shown on the drawings and not expressly mentioned in the specifications and all work specified but not shown on the drawings, but necessary for the proper execution of same shall be performed by the contractor. It is not the intent of the drawings and specifications to describe every feature and detail of the work.
E. No additions to the contract amount will be approved for any materials, equipment, or labor to perform additional work unless it can be clearly shown to be beyond the scope and intent of the drawings and specifications.
F. Provide roof penetrations for electrical work and all associated roof work.
G. Provide power to HVAC and plumbing equipment as necessary to have complete, operating systems.
H. Provide grounding in accordance with the NEC.
I. Base bid is to provide all primary cable, transformer coils, busways, switchboards, panelboards, and all feeders as copper conductors. Alternate bid is to provide all as aluminum conductors of equivalent current carrying capacity.
J. Provide code required signage (i.e., NEC 110.34, NEC 700.8, and 695.4 B3).
K. Refer to Commissioning of Systems Specification for additional scope of work.

1.07 SITE INSPECTION

A. Visit site, inspect, and become aware of all conditions which may affect the work. 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 being in compliance with this requirement. Contractor may not request additional costs for existing conditions which were evident from inspection of the site.
C. Before ordering materials or commencing with any work, the contractor shall verify all measurements at the building. Coordination of equipment, materials, spaces, and dimensions are the responsibility of the contractor.

1.08 DRAWINGS AND SPECIFICATIONS

A. Drawings and specifications are intended to be taken as a whole and each is to supplement the other. It is not intended that all work must be both shown on drawings and specified in the specifications.
B. An item shown on the drawings and not indicated in the specifications is to be understood to be required for the project. An item specified and not shown on the drawings is to be understood to be required for the project.
C. If there is a conflict between the drawings and specifications it is to be understood that the more strict or more expensive interpretation shall govern. Also, if a conflict exists between specification sections or between drawing plans and details, it is to be understood that the more strict or more expensive interpretation shall govern.
D. The architect’s or engineer’s interpretation of the documents shall be binding upon the contractor. If a question arises, the contractor shall ask for an interpretation prior to bidding and an answer shall be issued as an addendum to all bidders.
E. If a question arises after bidding the architect’s and/ or engineer’s interpretation shall govern.

F. The drawings are generally diagrammatic and necessary field coordination and adjustment must be provided by the contractor prior to installation. Such deviations to the work to allow for coordination shall be kept to a minimum and any such deviations shall be at no extra cost.

1.09 MINIMUM INTEGRATED EQUIPMENT SHORT CIRCUIT RATING:

A. Where the contract documents indicate secondary service from the utility Company (208/120V, 3 phase, or 480/277V, 3 phase) available short circuit currents including system motor contribution (amperes RMS symmetrical) at the line terminals of the UL service entrance labeled main distribution panelboard or switchboard, shall be in accordance with the following tabulation:

Service Minimum	**Service Entrance**	**Panelboard Rating**	**Transformer Rating**
kVA	%Z	208/ 120V	480/ 277V
75	1.5	14,500	10,000
112.5	1.5	22,000	10,000
125	1.5	29,000	13,000
225	1.5	43,000	19,000
300	1.5	58,000	25,000
500	1.5	96,000	42,000
750	5.5	42,200	18,000
1000	5.5	56,100	24,500
1500	5.5	85,000	37,000
2000	5.5		49,000
2500	5.5		51,000
3000	5.5		73,500

B. The Integrated Equipment short circuit rating of the main distribution panel, or switchboard shall meet or exceed the tabulated minimum values. This shall be construed to mean that the equipment withstands capability (bus-bracing), and interrupting capacities of main and feeder devices, shall each meet or exceed the tabulated minimum values.

C. Service transformer ratings shall be as indicated on the drawings. If said ratings are not indicated, the contractor shall contact the engineer and/ or utility company for clarification.

D. The only deviations from this tabulation that are permissible shall be the results of a short circuit study (if and as specified in Section 26 05 73 Power System Studies), or documented data from the utility company.

1.10 PROGRESS SCHEDULE

A. Provide a project schedule which shall show start, sequence of each type of work, milestone schedule, and completion of each type of work, with overall completion date.

1.11 COST SCHEDULE

A. Provide a detailed cost breakdown indicating labor and material amounts for various types of work.

B. AIA forms are required for this submission.

1.12 OFFICE

A. The contractor shall set up his job office (desk) where directed by the owner.

1.13 STORAGE

A. Material shall be stored only where directed by the owner.

1.14 SANITARY

A. The contractor will at his own expense, provide and maintain in a sanitary condition, a portable chemical toilet.
B. Toilet will be located where directed by the owner.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials and equipment shall be new and in present production of major manufacturers.
B. All materials and equipment shall be in conformance with accepted trade standards as a minimum. Where specifications exceed any minimum standard, the specifications shall govern.
C. Reference of equipment in the singular shall be deemed to apply to as many such items as may be required to complete the work.
D. The word “provide” means “furnish and install complete, tested, and adjusted as necessary with all accessories, wiring methods, switching, lenses, mounting hardware, cover plates, hangers and supports”.

2.02 FASTENERS AND SUPPORTS

A. All work shall be securely fastened to building construction.
B. Utilize toggle or machine bolts in hollow construction.
C. Utilize machine screws for steel construction.
D. Utilize expansion shields for masonry construction.
E. Utilize lag bolts for wood construction.
F. All fasteners shall be galvanized or plated with rustproof finish.
G. Maximum load on fasteners shall be at a safety factor of 4:1 for a tested sample.

2.03 MOTOR STARTERS AND CONTACTORS

A. Single-phase manual motor starters with overloads shall be provided under the electrical portion of the work for fractional horsepower motors up to ½ HP.
B. Polyphase motor starters and motor starters above ½ HP shall be furnished under other portions of the work.
C. The starters in A, or B above shall be installed under the electrical portion of the work.
D. Polyphase starters shall be magnetic combination type, across-the-line, electrically operated, electrically held, three-pole assemblies, with arc-extinguishing characteristics, silver-to-silver renewable contacts, three-pole thermal bi-metallic, red “run” pilot light, individual phase

protection, with overload heaters matched to motors installed and with four auxiliary contacts, Hand-Off-Auto switch, and control transformer.

E. For single-phase motors above ½ HP provide magnetic combination, single-phase motor starters with overloads, non-fusible disconnect switch, red run pilot light, integral 120 volt control transformer with dual primary fusing, auxiliary contacts.

F. Starters shall be as manufactured by G.E., Cutler Hammer, Siemens, Square D or Allen Bradley.

G. Contactors shall be across-the-line, electrically operated, mechanically held three-pole assemblies for tungsten and ballast luminaire loads. Acceptable manufacturers: GE, Cutler Hammer, Siemens, Square D or Allen-Bradley.

H. Manual motor starters without overloads in NEMA 1 enclosure equal to G. E. Type TC shall be used for the following load:
   1. 30 amperes or less, continuous.
   2. 1 HP or less at 120 volts
   3. 2 HP or less at 240 volts

2.04 MANUFACTURERS' NAMES

A. Manufacturers' names are included herein to establish those suppliers who may provide products for this project subject to the requirements of the specifications. Although a manufacturer's name may appear as an acceptable supplier it is not understood that a standard product is acceptable. Products must also meet the technical, performance, and physical requirements of the project as well as being named in the specification. Any deviations from this must be acknowledged during the bid phase by the supplier, who shall be solely responsible for any and all costs associated with the application of their product(s) in the project.

B. A design cannot be prepared which accommodates the installation of all suppliers and is not intended to do so. If certain modifications must be made to accommodate one particular supplier's equipment it shall be considered the contractor's responsibility to arrange for such accommodations and be financially responsible for same.

PART 3 - EXECUTION

3.01 WELDING

A. All electric power for arc welding shall be supplied by the contractor performing the work.

3.02 VEHICLES

A. Vehicle access to the site will be as directed by the owner.

3.03 RUBBISH DISPOSAL

A. Except for items or materials identified to be reused, salvaged, reinstalled, or otherwise indicated to remain property of the owner or tenant, demolished materials shall become the contractor's property and shall be removed, recycled, or disposed from the project site in an appropriate and legal manner.

B. Burning of debris on the site shall not be permitted. All debris, refuse, and waste shall be removed from the premises at regular intervals. No accumulation shall be permitted.

3.04 WORKMANSHIP

A. Maintain all public walks and access ways.
B. Erect and maintain barricades, warning signs, and other protective means as may be directed by the owner for protection of all persons and property from injury or damage.
C. Plug or cap open ends of piping systems and conduit.
D. Stored materials shall be covered to prevent damage by inclement weather, sun, dust, or moisture.
E. Protect all installed work until accepted in place by the owner. Protect luminaires.
F. Do not install plates, covers, and other finished devices until masonry, title, and painting operations are complete, or protect otherwise.
G. Protect all existing or new work from operations which may cause damage such as hauling, welding,
soldering, painting, insulation and covering.
H. All devices and exposed raceways are to be plumb and true. All exposed raceways in finished areas are to be coordinated with the architect/engineer prior to installation.

3.05 SCAFFOLDING

A. The contractor shall at his own expense, install, operate, protect, and maintain temporary services such as scaffolding, material hoists, access walks, etc., as may be required.

3.06 SITE UTILITIES

A. The contractor may use the existing water and electric power for temporary construction needs.
B. The owner will direct where these services may be tapped.
C. Those services that are used during construction, but are to remain, shall be refurbished to a new condition before turning back over to the owner.

3.07 CLEAN-UP

A. Remove all visible temporary tags or labels as well as any protective coverings and wrappings from fixtures and equipment.
B. Remove all spots, stains, soil, paint, spackle, and other foreign matter from all finished work.
C. Remove all trash and debris from the premises.

3.08 LUBRICATION

A. Furnish and 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.

3.09 EQUIPMENT START UP

A. Verify proper installation by manufacturer or his representative.
B. Advise the architect and engineer two 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 the architect and engineer.

3.10 OPERATING INSTRUCTIONS AND MANUALS

A. Properly and fully instruct owner’s personnel in the operation and maintenance of all systems and equipment.
B. Ensure that the owner's personnel are familiar with all operations to carry on required activities.
C. Such installation 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, owners’ personnel, vendor, and that a full operating and maintenance manual has been reviewed.
E. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalog cuts, wiring diagrams, piping diagrams, control sequences, service requirements, names and addresses of vendors, suppliers, and emergency contacts. Three manuals shall be provided to owner.
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 to operate any of the equipment.

3.11 PENETRATION SEALING

A. All penetrations of Natatorium walls, fire walls, smoke walls, and floors shall be sealed around conduits and wiring to prevent the flow of gases or smoke.
B. The sealant shall be foamed in place between the conduit or wiring and the adjacent walls and floors with Dow/ Corning RTV foam or Fire Stop Caulk.
C. All penetrations through roof structure shall be coordinated with other trades to minimize the potential for water seepage and leakage through such penetrations.
D. When electrical boxes are located on opposite side of a fire resistance rated wall assembly are within 2’-0” horizontally of each other, both devices are to be wrapped with Spec Seal Putty Pads as manufactured by Specified Technologies, Inc., or approved equivalent.

3.12 EQUIPMENT SETTING

A. Furnish and install as a minimum, a 0’-4" high concrete pad beneath all floor-mounted equipment.
B. Furnish and install as a minimum, spring vibration isolators under any equipment 10 HP and over and rubber-in-shear vibration isolation under all equipment less than 10 HP.
C. Reinforce concrete with No. 4 rods 12'-0” on center, both ways.
D. Pad to have 3/4" dowels into concrete at one per four square feet.

3.13 INSTALLATION MOUNTING HEIGHTS

A. To be verified by Architect, but in general shall be as follows (top of device elevation above finished floor):

Lighting switches, controls:	3’-10”
Duplex receptacles:	1’-8”
Duplex receptacles over counters:	0’-8" above countertop
Telephone data wall plate and modular jack, desk phone:	1’-8”
Telephone, data wall plate and modular jack, wall phone:	3’-10”
Special outlets:	As required for equipment
Fire alarm annunciating devices:	85"
Fire alarm manual pull stations:	3’-10”
Clock receptacles:	As indicated on drawings.
CATV wall plates and modular jacks:	1’-8”
CATV wall plates and modular jacks mounted near ceiling:	Coordinate mounting height with Architect.
Thermostats (forward reach):	3’-10”
Thermostats (side reach):	3’-10”
Thermostats with lockable cover:	4’-6”

Requirements of the Americans with Disability Act and/or ANSI A117.1 shall be met.

B. Structural and mechanical details shall be coordinated before roughing in.

3.14 COORDINATION

A. Coordinate with work of other trades prior to installation.
B. Arrange for minor variations for complete coordinated installation. Provide all necessary offsets to install the work and to provide clearances for other trades.

3.15 CUTTING AND PATCHING

A. Provide for cutting and patching for all electrical work.
B. Patching to be performed by tradesmen skilled in that particular trade.
C. Contractor shall patch and repair any existing openings created by the demolition work in floors, walls, partitions, and ceilings not being reused for the new construction.

3.16 BALANCING AND TESTING

A. Electrically balance connected loads in panels.
B. The entire wiring system shall be tested to be free from grounds and faults.
C. Identify all circuits and all phase wiring at terminations.

3.17 EQUIPMENT FURNISHED BY OTHERS

A. This contractor shall make final electrical connections to equipment furnished by other contractors or the owner.
B. Provide electrical service, and disconnect equipment as required by code to supply such equipment.

3.18 EXCAVATION, SHORING, PUMPING, BACKFILLING

A. Perform all excavation required to install the work. Deposit excavated material as so not to create a slide hazard.
B. Maintain excavations free of water.
C. Backfill with clean material and pneumatically tamp in 0'-8" layers. Remove excess material, including rock, from site or as directed by the architect and engineer.
D. Return to original conditions any areas disturbed for excavation.
E. Install all work neatly, trim, and plumb with building lines.
F. Install work in spaces allocated.
G. Cutting and patching shall be performed by skilled tradesmen normally employed for the work involved.

3.19 RECESSES

A. Furnish information to the General Contractor as to sizes and locations of recesses required to install panels, boxes, grilles, and other equipment, and/ or devices which are to be recessed in walls.
B. Make offsets or modifications as required to suite final locations.

3.20 LABELING

A. All equipment panels, controls, safety switches, and devices shall be provided with permanent black laminated micarta white core labels with 3/8" high letters.
B. This shall also apply to all controllers, remote start/ stop pushbuttons, equipment cabinets, and wherever directed by the architect and engineer.
C. This shall not apply to individual room thermostats, and local light switches.

3.21 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.
B. Guarantee shall be extended for all non-operational periods due to failure within the guarantee period.

3.22 AS BUILT DRAWINGS

A. At the completion of the work and prior to final payment, the contractor shall furnish a reproducible as-built drawing to the architect and engineer for approval. The drawings shall indicate all work installed and its actual size, and location and identify all systems installed with locations of concealed devices, conduit, piping and other equipment and complete wiring diagrams of all systems. If acceptable, the architect and engineer will submit the as-built drawings to the owner as record drawings. If not acceptable, the architect and engineer return the drawing to the contractor to make corrections as required. The contractor will resubmit for approval.
B. The as-built drawings shall indicate measured dimensions of underground lines and other concealed work.
C. To aid in the preparation of as-built drawings, the engineer can provide the electronic files for use by the contractor. The electronic files will be provided upon execution of the engineer's electronic file release contract prepared specifically for this project. The electronic files will be released in the format used by the architect and engineer to design the project. If this file format is not compatible with the contractor's needs, additional charges for providing the

changes to the requested file format may be necessary at $150.00 per hour billable to the contractor.

3.23 WORK COMPLETION

A. The contractor shall promptly correct work rejected by the engineer or failing to conform to the requirements of the contract documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed, or completed. Costs of correcting such rejected work, including additional testing and inspections and compensation for the engineer's services and expenses made necessary thereby, shall be at the contractor's expense.

3.24 REQUEST FOR INFORMATION (RFI) REQUIREMENTS

A. All RFI's shall include the following information based on AIA Document G716:
   1. To, From, Project Name, Issue Date, RFI number in sequential order with all other trades, Requested Reply Date.
   2. Provide a description with specification and/or drawing references.
   3. Provide the sender's recommendation including cost and/or schedule considerations.
   4. Provide receiver's reply space.
   5. Note an RFI reply is not an authorization to proceed with the work involving additional cost/time.

3.25 SHOP DRAWING REQUIREMENTS

A. The following is a list of required shop drawings for this project.

ELECTRICAL	**DATE REC'D**	**ACTION**	**DATE REC'D**	**ACTION**
Basic Materials and Equipment (Section 26 05 00 and 26 27 00)				
Panelboards (Section 26 24 16)				
Safety Switches - (Section 26 28 16)				
Fire Alarm and Detection Systems (Section 28 30 00)				
As-Builts				
Warranties				
Maintenance Manuals				
Instructions				
Ground Test				

END OF SECTION

SECTION 26 01 26 - EXISTING EQUIPMENT TO BE REUSED

PART 1 - GENERAL

1.01 REFERENCE

A. Refer to section 26 00 00 for requirements which are applicable to this section.
B. Refer to National Electrical Testing Association Standards, particularly NETA MTS-1997 and NETA ATS-1999.

1.02 WORK INCLUDED

A. Provide all labor, material, equipment, and supervision necessary to refurbish existing equipment as specified herein and place into operation.
B. All work and accessories required to perform the intended work is to be included in the scope of work.

1.03 QUALITY ASSURANCE

A. Verify that all equipment is installed in accordance with the manufacturer's recommendations.
B. Install systems and equipment in accordance with current applicable codes.
C. Provide adequate supervision of labor force to see that installations are complete and correct.
D. Testing Agency’s Field Supervisor and/ or Technicians are to be certified according to NETA ETT-2000.

1.04 SCOPE

A. It is the intent to totally refurbish existing equipment to as-new operating condition and efficiency. All parts to be made operable, corrosion removed, repainted, adjusted, cleaned, lubricated, and repaired as necessary.
B. Schedule outages with owner to minimize downtown. Have parts and supplies for repairs available beforehand.

PART 2 - PRODUCTS

2.01 PARTS

A. Replacement parts shall be manufactured by the original equipment supplier or approved substitute. Any substitute shall be submitted to the engineer for approval prior to use.

PART 3 - EXECUTION

3.01 PANELBOARDS, SWITCHBOARDS, LOAD CENTERS

A. Visually inspect enclosures, bus, and all cable terminations. Report signs of cable overheating, insulation degradation, excessive moisture, rust, etc.
B. Clean, wire-brush, and paint all corroded and rusted areas with Rustoleum/ Gavanoleum to match existing.
C. Undo cable terminations, as necessary. Clean with approved electrical cleaner and reconnect to manufacturer's recommended torque.
D. Replace existing overcurrent protection devices with new devices of similar kAIC ratings. This applies to all overcurrent protection devices rated 100 Amps, or less, and more than 20 years old.
E. Switchboard fused switches are to be cycled on/ off several times to ensure operability. Lubricate pivot point(s) as necessary, and/ or as recommended by the manufacturer.
F. Provide fuse clamps for each fused switchboard switch exceeding 100 Amps.

3.02 SAFETY SWITCHES

A. Visually inspect enclosure, bus, or cable terminations. Report signs of cable overheating, insulation degradation, excessive moisture, rust, etc.
B. Clean, wire-brush, and paint all corroded and rusted areas with Rustoleum/ Gavanoleum to match existing.
C. Cycle switch(es) on/ off to ensure operability. Lubricate pivot point(s) as necessary as recommended by manufacturer.
D. Replace switch as necessary.

END OF SECTION

SECTION 26 05 00 - FIRE-STOPPING

PART 1 - GENERAL

1.01 SUMMARY

A. Refer to section 26 00 00 for requirements which are applicable to this section.
B. Refer to International codes.
C. Section includes:
   1. Through-penetration fire stops and smoke-stops for all fire-rated bearing and non-bearing wall and floor assemblies, both blank (empty) and those accommodating penetrating items such as cables, conduits, pipes, ducts, etc.

1.02 REFERENCES

A. American Society for Testing and Materials Standards (ASTM):
   1. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM E814: Standard Test method for Fire Tests of Through-Penetration Fire Stops.
B. Underwriters Laboratories, Inc.:
   1. UL 723 Surface Burning Characteristics of Building Materials
   2. UL 1479 Fire Tests of Through-Penetration Fire Stops.
C. UL Fire Resistance Directory:
   1. Through Penetration Fire Stop Devices (XHJI)
   2. Fire Resistive Ratings (BXUV)
   3. Through Penetration Fire Stop Systems (XHEZ)
   4. Fill, Void, or Cavity Material (XHHW)

1.03 DEFINITIONS

A. FIRE-STOPPING: The use of a material or combination of materials in a fire rated structure (wall or floor) where it has been breached to restore the integrity of the fire rating on that wall or floor.
B. SYSTEM: The use of a specific fire stop material or combination of materials in conjunction with a specific wall or floor construction type and a specific penetrant(s), constitutes a “System.”
C. BARRIER: Any bearing or non-bearing wall or floor that has an hourly fire and smoke rating.
D. THROUGH-PENETRATION: Any penetration of a fire-rated wall or floor that completely breaches the barrier.
E. MEMBRANE-PENETRATION: Any penetration in a fire rated wall that breaches only one side of the barrier.
F. CONSTRUCTION GAPS: any gap, joint, or opening, whether static or dynamic, where the top of a wall may meet a floor; wall-to-wall applications; edge-to-edge floor configurations; floor-to-exterior wall; or any linear breach in a rated barrier. Where movement is required, the fire stopping system must comply with UL2079 for dynamic joints.

1.04 SUBMITTALS

NOTE: A “Certificate of Conformance” from the manufacturers listed in Section “2.02 ACCEPTABLE MANUFACTURERS,” is required with the “Submittal Package” to ensure that the material selected meets all of the criteria of this specification as set forth in Section “1.05 QUALITY ASSURANCE.”

A. Submit manufacturer’s product literature for each type of fire-stop material to be installed. Literature shall indicate product characteristics, typical uses, performance and imitation criteria, and test data. Submittal shall comply with Section 26 00 00.
B. Material Safety Data Sheets (MSDS): Submit MSDS for each fire-stop product.
C. UL Tested Systems: Submit drawings showing typical installation details for the methods of installation. Indicate which fire-stop materials will be used and thickness(es) for different hourly ratings.
D. Engineering Judgments: Submit manufacturer’s drawings for all non-standard applications where no UL tested system exists. All drawings must indicate the “Tested” UL system upon which the judgment is based to assess the relevance of the judgment to some, known performance.
E. Submit manufacturer’s installation procedures for each type of product.
F. Approved Applicator: Submit document from manufacturer wherein manufacturer recognizes the installer as qualified or submit a list of past projects to demonstrate capability to perform intended work.
G. Upon completion, installer shall provide written certification that materials were installed in accordance with the manufacturer’s installation instructions and details.

1.05 QUALITY ASSURANCE

A. Fire-stopping systems (materials and design):
    1. Shall conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of field conditions.
        a. The F rating must be minimum of one hour but not less than the fire resistance rating of the assembly being penetrated. T rating when required by code authority shall be based on measurement of the temperature rise on penetrating item(s). The fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column.
    2. For joints, must be tested to UL 2079 with movement capabilities equal to those of the anticipated conditions.
B. Fire-stopping materials and systems must be capable of closing or filling through openings created by:
    1. The burning or melting of combustible pipes, cable jacketing, or pipe insulation materials, or.
    2. Deflection of sheet metal due to thermal expansion (electrical and mechanical duct work).
C. Fire-stopping material shall be asbestos and lead-free and shall not incorporate nor require the use of hazardous solvents.
D. Fire-stopping sealants must be flexible, allowing for normal pipe movement.
E. Fire-stopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.
F. Fire-stopping materials shall be moisture resistant and may not dissolve in water after curing.
G. All fire-stopping materials shall be manufactured by one manufacturer (to the maximum

extent possible).

H. Installation of fire-stopping systems shall be performed by a contractor (or contractors) trained or approved by the fire-stop manufacturer.

I. Material used shall be in accordance with the manufacturer's written installation instructions.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver material in the manufacturer's original, unopened containers or packages with the manufacturer's name, product identification, lot number, UL label and mixing and installation instructions as applicable.

B. Store materials in the original, unopened containers or packages and under conditions recommended by the manufacturer.

C. All fire-stop materials will be installed prior to expiration of shelf life.

1.07 PROJECT CONDITIONS

A. Conform to manufacturer's printed instructions for installation and when applicable, curing in accordance with temperature and humidity. Conform to ventilation and safety requirements.

B. Contractor shall verify the condition of the substrates before starting work.

C. Weather Conditions: Do not proceed with installation of fire-stop materials when temperatures fall outside the manufacturer's suggested limits.

D. Care shall be taken to ensure that fire-stopping materials are installed so as not to contaminate adjacent surfaces.

1.08 SEQUENCING

A. Schedule fire-stopping after installation of penetrants but prior to concealing the openings.

B. Fire-stopping shall precede gypsum board finishing.

1.09 PROTECTION

A. Where fire-stopping is installed at locations which will remain exposed in the completed work, provide protection as necessary to prevent damage to adjacent surfaces and finishes, and protect as necessary against damage from other construction activities.

PART 2 - PRODUCTS

2.01 GENERAL

A. Fire-stopping materials and systems shall meet the requirements specified herein.

B. Architect must approve in writing any alternates to the materials and system specified herein.

C. All fire-stop products and systems shall be designed and installed so that the basic sealing system will allow the full restoration of the thermal and fire resistance properties of the barrier being penetrated with minimal repair if penetrants are subsequently removed.

D. For applications where combustible penetrants are involved, i.e., insulated, and plastic pipe, a suitable intumescent material must be used.

2.02 ACCEPTABLE MANUFACTURERS

NOTE: Inclusion of materials in this specification does not indicate that the listed products have been evaluated for conformance to this specification. Therefore, the user/ contractor must certify in the submittal package, with a “Certificate of Conformance” from the manufacturers listed below, that the material selected meets all of the criteria set forth in Section “1.05 QUALITY ASSURANCE” of this specification.

A. Specified Technologies, Inc. /GE Pensil® (STI), Somerville, NJ 08876, Phone: (800) 992-1180.
B. 3M Fire Protection Products, St. Paul, MN

2.03 MATERIALS

A. Intumescent Fire-stop Sealants and Caulks:
   1. STI SpecSeal SSS100
   2. 3M Fire Barrier Caulk CP25WB+
B. Latex Fire-stop Sealant
   1. STI SpecSeal LC150 Sealant
C. Elastomeric Water-Based Sealant
   1. STI SpecSeal ES100 Elastomeric Sealant
D. Silicone Fire-stop Sealants and Caulks:
   1. STI SpecSeal Pensil 300
   2. 3M Fire Barrier Silicone Sealants
E. Fire-stop Putty:
   1. STI SpecSeal Fire-stop Putty Bars and Pads
   2. 3M Fire Barrier Moldable Putty
F. Fire-stop Collars:
   1. STI Spec Seal Fire-stop Collars
   2. 3M Fire Barrier PPD’s.
G. Wrap Strips:
   1. SpecSeal Wrap Strip
   2. 3M Fire Barrier FS195 Wrap Strip.
H. 2-Part Silicone Fire-stop Foam:
   1. STI SpecSeal Pensil 200
   2. 3M Fire Barrier 2001 Silicone Foam.
I. Fire-stop Mortar:
   1. STI SpecSeal Mortar.
J. Fire-stop Pillows:
   1. STI SpecSeal Pillows
K. Elastomeric Spray:
   1. STI SpecSeal AS Elastomeric Spray
L. Composite Board:
   1. 3M Barrier Sheet Material
M. Accessories:
   1. Forming/Damming Materials: Mineral fiberboard or other type as per manufacturer recommendation.

PART 3 - EXECUTION

CONDITIONS REQUIRING FIRE-STOPPING

A. General:
   1. Provide fire-stopping for conditions specified whether fire-stopping is indicated or not, and if indicated, whether such material is designed as insulation, safing, or otherwise.

B. Through-Penetrations:
   1. Fire-stopping shall be installed in all open penetrations and in the annular space in all penetrations in any bearing or non-bearing fire-rated barrier.

C. Membrane-Penetrations:
   1. Where required by code, all membrane-penetrations in rated walls shall be protected with fire-stopping products that meet the requirements of third-party time/ temperature testing.

D. Construction Joints/ Gaps:
   1. Fire Stopping shall be provided:
      a. Between the edges of floor slabs and exterior walls.
      b. Between the tops of walls and the underside of floors
      c. In the control joint in masonry walls and floors
      d. In expansion joints.

E. Smoke-Stopping:
   1. As required by the other Sections, smoke-stops shall be provided for through-penetrations, membrane-penetrations, and construction gaps with a material approved and tested for such application.

3.02 EXAMINATION

A. Examine the areas and conditions where fire-stops are to be installed and notify the architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected by the contractor in a manner acceptable to the architect.

B. Verify that environmental conditions are safe and suitable for installation of fire-stop products.

C. Verify that all pipe, conduit, cable, and other items which penetrate fire-rated construction have been permanently installed prior to installation of fire-stops.

3.03 INSTALLATION

A. General:
   1. Installation of fire-stops shall be performed by an applicator/ installer qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer’s detailed installation procedures.
   2. Apply fire-stops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer’s recommendations.
   3. Unless specified and approved, all insulation used in conjunction with through-penetrants shall remain intact and undamaged and may not be removed.

4. Seal holes and penetrations to ensure an effective smoke seal.
5. In areas of high traffic, protect fire-stopping materials from damage. If the opening is large, install fire-stopping materials capable of supporting the weight of a human.
6. Insulation types specified in other sections shall not be installed in lieu of fire-stopping material specified herein.
7. All combustible penetrants (e.g., non-metallic pipes or insulated metallic pipes) shall be fire-stopped using products and systems tested in a configuration representative of the field condition.

B. Dam Construction:
1. When required to properly contain fire-stopping materials within openings damming or packing materials may be utilized. Combustible damming material must be removed after appropriate curing. Non-combustible damming materials may be left as a permanent component of the fire-stop system.

3.04 FIELD QUALITY CONTROL

1. Prepare and install fire-stopping systems in accordance with manufacturer's printed instructions and recommendations.
2. Follow safety procedures recommended in the Material Safety Data Sheets.
3. Finish surfaces of fire-stopping which are to remain exposed in the completed work to a uniform and level condition.
4. All areas of work must be accessible until inspection by the applicable Code Authorities.
5. Correct unacceptable fire-stops and provide additional inspection to verify compliance with this specification.

3.05 CLEANING

1. Remove spilled and excess materials adjacent to fire-stopping without damaging adjacent surfaces.
2. Leave finished work in neat, clean condition with no evidence of spill overs or damage to adjacent surfaces.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING SYSTEMS: GENERAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of system described in other Sections.

B. Related Sections include the following:
   1. 26 41 13 - LIGHTNING PROTECTION for additional grounding and bonding materials.

1.03 SUBMITTALS

A. Product Data - For the following:
   1. Ground rods.
   2. Chemical rods.

1.04 Qualification Data: For firms and persons specified in 1.05 QUALITY ASSURANCE Article.

A. Field Test Reports: Submit written test reports to include the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.
   1. Testing Agency’s Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in PART 3 - EXECUTION.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   1. Comply with UL 467.

C. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Grounding Conductors, Cables, Connectors, and Rods:
      a. Chance/ Hubbell
      b. Copperweld Corp.
      c. Erico Inc.; Electrical Products Group.
      d. Framatome Connectors/Burndy Electrical
      e. Galvan Industries, Inc.
      f. Ideal Industries, Inc.
      g. Kearney/ Cooper Power Systems.
      h. Korns: C.C. Korns Co.; Division of Robroy Industries.
      i. Lyncole XIT Grounding.
      j. O-Z/Gedney Co.; a business of the EGS Electrical Group.\
      k. Raco, Inc.; Division of Hubbell.
      l. Salisbury: W.H. Salibury & Co.
      m. Superior Grounding Systems, Inc.
      n. Thomas & Betts, Electrical

2.02 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Section 26 27 00.
B. Material: Aluminum, copper-clad aluminum, and copper.
C. Equipment Grounding Conductors: Insulated with green-colored insulation.
D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two band of yellow.
E. Grounding Electrode Conductors: Stranded cable.
F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
G. Bare Copper Conductors: Comply with the following:
   1. Solid Conductors: ASTM B 3.
   2. Assembly of stranded Conductors: ASTM B8.
   3. Tinned Conductors: ASTM B33.
H. Copper Bonding Conductors: As follows:
   1. Bonding Cable: 28 kcmil, 14 strands of #17 AWG copper conductor, 1/4” Ø.
   2. Bonding Conductor: #4 or #6 AWG, stranded copper conductor.
   3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules: 1-5/8" wide and 1/16" thick.
   4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules: 1-5/8" wide and 1/16" thick.
I. Aluminum Bonding Conductors: As follows:
   1. Bonding Cable: 10 strands of #14 AWG aluminum conductor 1/4" Ø.
   2. Bonding Conductor: #4 or #6 AWG, stranded aluminum conductor.
   3. Bonding Jumper: Aluminum tape, braided bare aluminum conductors, terminated with aluminum ferrules: 1-5/8" wide and 1/16" thick.
J. Ground Conductor and Conductor Protector for Wood Poles: As follows:

1. #4 AWG aluminum, soft-drawn copper conductor.
2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir, cypress, or cedar.

K. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.03 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes and combinations of conductors and connected items.
B. Bolted Connectors: Bolted-pressure type connectors, or compression type.
C. Welded Connectors: Exothermic-welded type, in kit form, and selected per

2.04 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel.
B. Ground Rods: Section type; copper-clad steel.
   1. Size: 5/8” Ø.
C. Chemical Electrodes: Copper tube, straight or L-shaped, filled with nonhazardous chemical salts, terminated with a #4/0 bare conductor. Provide backfill material recommended by manufacturer.

PART 3 - EXECUTION

3.01 APPLICATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
B. In raceways, use insulated equipment grounding conductors.
C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.
D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
E. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
   1. Use insulated spacer; space 0’-1” from wall and support from wall 0’-6” above finished floor, unless otherwise indicated.
   2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.
F. Underground Grounding Conductors: Use tinned copper conductor, #2/0 AWG minimum. Bury at least 2’-0” below grade or bury 1’-0” above duct bank when installed as part of the duct bank.

3.02 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
B. Install equipment grounding conductors in all feeders and circuits.

C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:
   1. Feeders and branch circuits.
   2. Single-phase motor branch circuits.
   3. Three-phase motor branch circuits.

D. Busway Supply Circuits: Install insulated equipment grounding conductor from the grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

E. Bond metal parts, motor frames, fittings, plumbing pipes, drains, metal conduit, metal surfaces within 5'-0", and all electrical devices and controls within 5'-0".

F. Motors shall be grounded by means of a grounding conductor in the same raceway with the motor feeder connected to the grounding bushing at the motor terminal box and the ground bus in the motor control center or to the incoming conduit grounding bushing of an individually mounted motor starter.

3.03 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

3.04 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
   1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
   2. Make connections with clean, bare metal at points of contact.
   3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
   4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
   5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding Conductor Terminations: For #8 AWG and larger, use pressure-type grounding lugs. #10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise

indicated.

1. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

E. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

F. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.05 FIELD QUALITY CONTROL

A. Testing: Engage a qualified testing agency to perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81. (Ensure that the test is performed with all ground-to-neutral bands broken. The grounding system must be completely isolated for the test to be valid.)
3. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.01 REFERENCE

A. Refer to Section 26 00 00 for additional requirements of this section.
B. Refer to requirements of the NFPA 70 National Electrical Code, UL, and the NFPA.

1.02 WORK INCLUDED

A. Provide all labor, material, equipment, and supervision necessary to furnish and install panelboards as specified.

1.03 SUBMITTALS

A. Submit manufacturers shop drawings of all equipment specified in this section.

1.04 QUALITY ASSURANCE

A. Verify that all equipment is installed in accordance with the manufacturers' warranty requirements.

PART 2 - PRODUCTS

2.01 DISTRIBUTION PANELBOARDS (MDP or PP)

A. GENERAL - Furnish and install distribution and power panelboards as indicated in the panelboard schedule and where shown on the plans. Panelboards shall be equipped with thermal-magnetic, molded case circuit breakers of frame and trip ratings as shown on the schedule.
B. BUSSING ASSEMBLY AND TEMPERATURE RISE - Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Bus shall be plated copper.
C. CIRCUIT BREAKERS - Circuit breakers shall be equipped with individually insulated, braced, and protected connectors. Circuit breakers shall be flush with each other. Tripped indication shall be clearly shown. Provisions for additional breakers shall be such that no additional connectors will be required to add breakers. Mechanical lugs are to be copper. For 480-volt applications over 1000 Amp, the main breaker is to include electronic trip with LSIG characteristics.
D. ** INTEGRATED EQUIPMENT SHORT CIRCUIT RATING (SERIES RATED) - Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. (Method of testing shall be per Underwriters Laboratories Standard UL 67. The source shall

be capable of supplying specified panelboard short circuit current or greater). Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

E. ** EQUIPMENT SHORT CIRCUIT RATING (FULLY RATED) - Each panelboard shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

F. ARC ENERGY REDUCTION - Where circuit breakers rated 1200 Amp or higher are installed, provide arch flash mitigation documentation to those authorized to design, install, operated, or inspect the installation. Provide energy-reducing maintenance switching with local status indicator as means to reduce clearing time of the fuses or the breakers.

G. CABINET - Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67. Cabinets to be equipped with latch and tumbler-type lock on door of trim. Doors over 48" long shall be equipped with three-point latch and vault lock. All locks shall be keyed alike. End walls shall be removable. Fronts shall be of code gauge steel. Baked enamel finish electro-deposited over cleaned phosphatized steel.

H. SAFETY BARRIERS - The panelboard interior assembly shall be dead front with panelboard front removed. Main lugs or main breakers shall have barriers on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers.

I. UL LISTING - Panelboards shall be listed by Underwriters Laboratories and shall bear the UL label. When required, panelboards shall be suitable for use as service equipment.

J. NAMEPLATES - Provide laminated black phenolic resin with white core with 3/16” high engraved lettered nameplates for each circuit breaker to indicate the feeder, panelboard and equipment served. Mounted, with plated screws, adjacent to or on front of the breaker.

K. Panelboards shall be by Square D, Siemens, Cutler Hammer or ABB Group.

2.02 LIGHTING & RECEPTACLE PANELS (LP or RP)

A. GENERAL - Furnish and install circuit breaker lighting panelboards as indicated in the panelboard
schedule and where shown on the plans. Panelboards shall be equipped with thermal-magnetic molded case circuit breakers with frame and trip ratings as shown on the schedule.

B. CIRCUIT BREAKERS - Shall be quick-make, quick-break, thermal-magnetic, trip indicating and have common trip on all multipole breakers. Trip indication shall be clearly shown by the breaker handle taking position between "ON" and "OFF" when the breaker is tripped. Branch circuit breakers feeding convenience outlets shall have sensitive instantaneous trip settings of not more than ten times the trip rating of the breaker to prevent repeated arcing shorts resulting from frayed appliance cords. Single pole 15 and 20 Amp circuit breakers shall be UL listed as "Switching Breakers" at 120-volt AC and carry the SWD marking. UL Class A ground fault circuit protection shall be provided on 120-volt AC branch circuits as specified on the plans or panelboard schedule. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single pole circuit breaker with integral ground fault circuit interruption shall require no more panelboard branch circuit space than a conventional circuit breaker. A UL listed combination arc fault circuit interrupter (AFCI) shall be provided for all 120-volt, 15 or 20 Amp branch circuits as indicated on the plans or panelboard schedule or as required by the National Electrical Code. This protection shall be

an integral part of the branch circuit breaker which also provides overload and short circuit protection for the branch circuit wiring. This breaker shall require no more panelboard branch circuit space than a conventional circuit breaker. Connections to the bus shall bolt-on.

C. PANELBOARD BUS ASSEMBLY - Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type. Single phase, three-wire panelboard bussing shall be such that any two adjacent single pole breakers are connected to opposite polarities in such a manner that two pole breakers can be installed in any location. Three phase, four-wire bussing shall be such that any three adjacent single pole breakers are individually connected to each of the three different phases in such a manner that two or three pole breakers can be installed at any location. All current carrying parts of the bus assemble shall be plated copper. Main ratings shall be shown in the panelboard schedule or on the plans.

D. WIRING TERMINALS - Terminals for feeder conductors to the panelboard mains and neutral shall be UL listed as suitable for the type of conductor specified. Terminals for branch circuit wiring, both breaker and neutral, shall be UL listed as suitable for the type of conductor specified.

E. CABINETS AND FRONTS - The panelboard bus assemble shall be enclosed in a steel cabinet. The size of the wiring gutters and gauge of steel shall be in accordance with NEMA and UL Standards. The box shall be fabricated from galvanized steel or equivalent rust resistant steel.

Fronts shall include doors and have flush, cylinder tumbler-type locks with catches and spring- loaded stainless steel door pulls. Doors shall be mounted with completely concealed steel hinges. Fronts shall not be removable with door in the locked position. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. Fronts shall be of code gauge steel.

**Front panel cover is to be door in door construction with piano hinge.

F. ** INTEGRATED EQUIPMENT SHORT CIRCUIT RATING (SERIES RATED) - Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. (Method of testing shall be per UL Standard UL 67. The source shall be capable of supplying specified panelboard short circuit current or greater). Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

G. ** EQUIPMENT SHORT CIRCUIT RATING (FULLY RATED) - Each panelboard shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

H. UL LISTING - Panelboards shall be listed by Underwriters Laboratories and bear the UL label. Equal panelboards may be provided by Square D, G.E., Cutler Hammer, or Siemens.

I. ELECTRONIC GRADE - Panels indicated to be electronic grade to have 200% rated neutrals, and an isolated ground bar in addition to the equipment ground bar.

PART 3 - EXECUTION

3.01 PANELS

A. Panelboards are to be mounted in accordance with National Electrical Code Article 240.24 unless noted otherwise.
B. Provide labeling and complete, typed directories.
C. Ductwork or piping shall not pass over panels.
D. Space shall be clear 3’-0" in front of panel floor to structural slab or roof above.
E. All conduit entering the panel shall have a screwed hub with an insulated bushing and no sharp
F. edges.
   1. Wires shall be labeled and neatly arranged in the wiring gutters with wires cut to proper lengths and neatly racked.
G. Electronic grade panels shall have feeder neutrals rated at 200% to maintain the UL listing of the
panel and be provided with isolated ground conductor back to service entrance or feeder transformer.

3.02 GROUNDING

A. All panels shall be grounded to the building equipment grounding system per National Electrical Code Article 408.40. Ground resistance shall not exceed the National Electrical Code values.

END OF SECTION

SECTION 26 27 00 - BASIC MATERIALS AND EQUIPMENT FOR METAL RACEWAY SYSTEMS

PART 1 - GENERAL

1.01 REFERENCE

A. Refer to Section 26 00 00 for additional requirements of this section.
B. Refer to NEC 1-2000 for general installation requirements.

1.02 SUBMITTALS

A. Submit shop drawings and manufacturer's catalog sheets of all specified items unless waived by the engineer.
B. Submit switches and receptacles as a minimum.

PART 2 - PRODUCTS

2.01 RIGID METAL CONDUIT (GRS)

A. Material; Steel, Zinc coated Federal Specification WW-C-581d, ANSI C801.
B. Fittings; Malleable iron, Threaded
C. NEC; Article 344
D. Application; Indoor, above ground, enamel coated, all occupancies not subject to severe corrosive influences.
E. Manufacturer; Hubbell, Allied Tube and Conduit Corp. or approved equal.

2.02 ELECTRICAL METALLIC TUBING (EMT)

A. Material; Galvanized steel, U.L. labeled, Federal Specification ANSI C80.3.
B. Fittings; Threadless compression type for up to 1-1/4", set screw for 1-1/2" and larger. Installation in accordance with Article 358 of the National Electrical Code and U.L. general information card #FJMX.
C. NEC; Article 358
D. Application; Exposed and concealed work not subject to physical damage.
E. Manufacturer; Hubbell, Allied Tube and Conduit Corp. or approved equal.

2.03 FLEXIBLE METAL TUBING (FMT)

A. Material; Hot dipped galvanized interlocking convolutions of steel tape in circular cross section. Federal Specification AA-55810
B. Fittings; Hot dipped galvanized steel
C. NEC; Article 344
D. Application; All areas other than wet locations, hoistways, hazardous locations, below ground, and areas with exposure to oil, gasoline, or other materials having an adverse effect

on rubber.

E. Manufacturer; Electri-flex Company Liquatite Type BR, Hubbell, Allied Tube and Conduit Corp., AFC.

2.04 RIGID NON-METALLIC CONDUIT (SCHEDULE 40 PVC)

A. Material; U.L. 651, ANSI/ NEMA TC-2, Federal Military Specification WC-1094A, 90 °C wire rated and sunlight resistant.
B. Fittings; PVC, same as above.
C. NEC; Article 352
D. Application; In walls, floors, ceilings, wet locations, underground, and locations subject to severe corrosive influences.
E. Manufacturer; Carlon Schedule 40 electrical conduit or approved equal.

2.05 LIQUATITE FLEXIBLE METAL CONDUIT

A. Material: Hot dipped galvanized interlocking convolutions of steel tape in circular cross section with PVC jacket.
B. Fittings: Hot dipped galvanized steel.
C. NEC Article 350 (LFMC)
D. Application: All areas other than elevator hoistways, hazardous locations and where subject to physical damage.
E. Manufacturers: Electriflex Company Liquatite Type LT, Hubbell, Allied Tube and Conduit Corp., AFC.

2.06 CONDUCTORS

A. Type; THHN, 98% conductivity copper, 600-volt, dry locations. Type THWN for wet locations. Conductors shall be U.L. listed.
B. Equipment terminations for circuits rated 100 Amps or less (#14 AWG - #2 AWG) shall be rated 60 °C (140 °F). Equipment termination for circuits rated over 100 Amps (#1 or larger) shall be rated 75 °C (167 °F). Refer to NEC for allowable exceptions. 90 °C (194 °F) rated conductors shall be used as indicated on the drawings or as indicated within these specifications.
C. Solid copper conductors for #10 and #12 wire size. #8 and larger are to be stranded copper.
D. Separate green ground conductor for all circuits including branch, homerun, and feeders.
E. All conductors shall be color coded as follows:
120/ 208 Volt Systems

Phase A	Black
Phase B	Red
Phase C	Blue
Neutral	Grey or Natural White

Minimum size conductor shall be #12 AWG except that #14 AWG shall be used for control wiring. All circuit conductors shall be run in the same raceway system.
F. A grounding conductor shall be provided to each electrical device in accordance with the National Electrical Code.
G. Conductor sizes are to be as indicated on the drawings and/ or as specified in this specification.
H. Conductors are not to be installed in raceways until construction is advanced to allow conductors to be installed completely without damage to conductors and there is not

possibility of water or other contaminants entering the raceway system. Conductors shall be installed between convenient terminating points.

I. An approved pulling compound shall be used to assist in pulling of conductors.

J. Aluminum Alloy Conductors for Distribution Feeder Applications:
   1. Distribution feeder conductor's sizes #6 AWG to 1000 Kcmil may be copper (Base Bid) or aluminum alloy (Alternate). Aluminum alloy conductors are to be compact standard conductors of a recognizable Aluminum Association 8000 Series aluminum alloy conductor material (AA-8000 series alloy). AA-8000 series alloy conductor must be Alcan Cable Stabiloy or approved equal.
   2. Compliance with the elongation requirement per Table 10.1 of UL Standard 1581 for stranded AA-8000 series aluminum alloy conductors shall be determined on wires taken from the conductor after stranding by manufacturer.
   3. Insulation:
      a. For use in raceways: Type XHHW-2, temperature rating 90°C.
      b. For use in cable trays: Sizes #1/ 0 AEG and larger. Type XHHW-2, temperature rating 90°C and marked: "SUN RES", "VW-1"", "GASOLINE AND OIL-RESISTANT II", "FOR CT USE".

K. Manufacturers: Alpha Wire, Southwire, Tamaqua Cable, Triangle Wire & Cable, American Insulated Wire, BICC or General Cable.

2.07 JUNCTION BOXES

A. Material; Galvanized steel, accessible.
B. Manufacturers; Keystone, Hubbell, Penn Panel and Box Co.
C. NEC; Article 314

2.08 OUTLET AND SWITCH BOXES

A. Material; Galvanized steel with knockouts to suit raceway system.
B. Manufacturer; Crouse Hinds Co., Steel City Div., Raco Inc., or approved equal.

2.09 WALL PLATES - METAL- COMMERCIAL SPECIFICATION GRADE

A. Wall plates shall be standard size, metal, commercial grade.
B. Plates shall be provided for all switches, receptacles, blanks, telephone, and special purpose outlets.
C. Plates must be of modern design having rounded edges and corners and be complete with color-matched mounting screws.
D. Plates must be of one design throughout the building and shall conform to UL, CSA, and NEMA standards.
E. Engraving shall be done by plate manufacturer in accordance with the schedule.
F. Acceptable Manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, Leviton.

2.10 WALL PLATES - STAINLESS STEEL - TYPE 302 - CORROSIVE/ DAMPNESS/ FOOD SERVICE DUTY

A. Wall plates shall be Pass and Seymour Sierra Series "S", Type 430 Stainless Steel, or "S-N" line Type 302 Stainless Steel or equal and will conform to UL and NEMA standards.
B. Plates must be provided for all switches, receptacles, blanks, telephone and special purpose outlets.

C. Plates shall be of a modern design, having rounded edges and corners and be complete with finish-matching mounting screws.
D. Engraving shall be done by plate manufacturer in accordance with the schedule.
E. Plates must be of one design throughout the building.
F. Acceptable Manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, and Leviton.

2.11 RECEPTACLES - STANDARD DUTY - COMMERCIAL/ SPECIFICATION GRADE

A. All thermoplastic nylon body construction.
B. Impact-resistant nylon face.
C. One-piece triple-wipe brass power contact.
D. Available with side and back wire capable of accepting #14 - #10 AWG copper or copper-clad wire.
E. Terminal compartments isolated from each other for positive conductor containment.
F. Automatic grounding clip assures grounding to metallic boxes.
G. Easily accessible break off tabs to facilitate split circuit wiring.
H. Plated steel strap for corrosion resistance.
I. Combination Phillips/ slotted head screws backed out for ease of installation.
J. In compliance with UL 498.
K. Pre-wired pigtail connectors that accommodate Federal Specification Receptacles are approved. Must be crimped and welded terminal right angle application within the connector.
L. Receptacle shall be Federal Specification, WC896 compliant. Marking should be clearly identifiable on face or strap.
M. Acceptable Manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, and Leviton.
N. Leviton 5362/ 5361, 20 Amp, ivory, white, grey, black, brown or almond.

2.12 RECEPTACLES - DECORA - SPECIFICATION GRADE

A. Impact-resistant nylon face.
B. One-piece, triple-wire brass power contacts.
C. Corrosion resistant, plated, wrap-around steel strap locked into assembly to prohibit strap from bending away from body.
D. Terminal compartments isolated from each other for positive conductor containment.
E. Available in hospital grade & specification grade.
F. Heavy-duty compact design for easier installation and long-lasting performance.
G. Automatic grounding clip standard for positive ground to metal boxes.
H. All devices fit standard #26 opening wall plate.
I. Side and back wire accepts #14 - #10 AWG.
J. In compliance with UL 498.
K. Pre-wired pigtail connectors that accommodate Federal Specification Receptacles are approved. Must be crimped and welded terminal right angle application within the connector.
L. Receptacle shall be Federal Specification, WC896 compliant. Marking should be clearly identifiable on face or strap.
M. Acceptable manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, and Leviton.
N. Leviton 16352, 20 Amp, white, ivory, grey, black, or almond.

2.13 GROUND FAULT CIRCUIT INTERRUPTING RECEPTACLES - STANDARD GRADE

A. Side or screw pressure plate back wire with #14 or #12 AWG solid or y-stranded copper wire.

B. Extra-long strap.
C. High-impact resistant thermoplastic construction.
D. Ground screw with a wire guide channel.
E. Dual-direction test and reset buttons.
F. Line and load terminations supplied backed out, and ready to wire.
G. Two back wire holes per terminal.
H. Ultrasonic welding of face to back body.
I. Mis-wire label applied to load terminals.
J. GFCI receptacle are to have SafeLock protection. If critical components are damaged and ground fault protection is lost or if mis-wired, power to receptacle is disconnected.
K. Class A rated GFCI
L. 1-1/ 2 HP rating on Motor Control GFCI switch (2081 series).
M. Button colors match the device face.
N. Supplied with matching wall plate.
O. In compliance with UL-943, UL-498, UL-508.
P. Pre-wired pigtail connectors that accommodate Federal Specification receptacles are approved. Must be crimped and welded terminal right angle application within the connector.
Q. Receptacle shall be Federal Specification, WC896 compliant. Marking should be clearly identifiable on face or strap.
R. Acceptable Manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, and Leviton.
S. Leviton 6898, 20 Amp, ivory, white, almond, or mahogany.

2.14 TAMPER RESISTANT RECEPTACLES - COMMERCIAL

A. Thermoplastic shutter for reliable tamper-resistant design.
B. High-impact thermoplastic face and body.
C. One-piece Brass Alloy grounding system.
D. High performance copper alloy contacts assure the highest degree of blade retention.
E. Ground contacts are encapsulated in thermoplastic body.
F. Side or back wiring accepts #10, #12 or #14 AWG copper.
G. Eight hold back wiring for convenient feed thru wiring.
H. In compliance with UL-498.
I. Pre-wired pigtail connectors that accommodate Federal Specification receptacles are approved. Must be crimped and welded terminal right angle application within the connector.
J. Receptacle shall be Federal Specification, WC896 compliant. Marking should be clearly identifiable on face or strap.
K. Acceptable manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, and Leviton.
L. Leviton 8300-SG, 20 Amp, ivory, white, grey, red or brown.

2.15 TAMPER RESISTANT RECEPTACLES - DECORA

A. Thermoplastic shutter for reliable tamper-resistant design.
B. High-impact thermoplastic face and body.
C. One-piece Brass Alloy grounding system.
D. High performance copper alloy contacts assure the highest degree of blade retention.
E. Ground contacts are encapsulated in thermoplastic body.
F. Side or back wiring accepts #10, #12 or #14 AWG copper.
G. 8-hold back wiring for convenient feed thru wiring.
H. In compliance with UL-498.
I. Pre-wired pigtail connectors that accommodate Federal Specification Receptacles are

approved. Must be crimped and welded terminal right angle application within the connector.

J. Receptacle shall be Federal Specification, WC896 compliant. Marking should be clearly identifiable on face or strap.
K. Acceptable manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, and Leviton.
L. Leviton 16262-SG, 20 Amp, ivory, white, red or orange.

2.16 TOGGLE SWITCHES - COMMERCIAL DUTY SPECIFICATION GRADE

A. One-piece brass alloy contact arm.
B. Thermoset body and cover for superior heat resistance.
C. High strength polycarbonate toggle resists breaking and chipping under heavy abuse.
D. Available with side wire or side and back wire models capable of accepting #14 - #10 AWG copper or copper-clad wire.
E. Cam designed for fast make with positive break action to minimize arcing and prolong switch life.
F. Heavy-duty toggle bumpers for smooth and quiet operation.
G. Oversized silver alloy contacts for longer dependable switch life.
H. Plated steel strap for corrosion resistance.
I. Combination Phillips/ slotted head screws backed out for ease of installation.
J. In compliance with UL 20.
K. Switches shall be Federal Specification WC596 compliant. Marking should be clearly identifiable on face or strap.
L. Acceptable Manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, and Leviton.
M. Leviton CS120-2/ CS320-2/ CS420-2, 20 Amp, 120/ 277 V, ivory, white, black, grey, or almond.

2.17 ROCKER SWITCHES - SPECIFICATION GRADE

A. Impact-resistant thermoplastic nylon back body and frame.
B. Cushioned nylon paddle assures smooth, quiet, long-term operation.
C. Unique single rocking butterfly contact provides long term consistent performance with significantly fewer moving parts.
D. Internal back and side wire capability for easy installation with #14 – 10 AWG stranded or solid copper/ copper clad wire. Terminals made of high conductivity brass and serrated for maximum wire gripping.
E. Color-coded back bodies for positive identification of switch rating.
F. Silver alloy contacts integrally formed to the butterfly actuator assures reliable performance.
G. Integral auto ground clip for positive ground to metal boxes.
H. Brass binding head terminal screws are combination Phillips/ slotted. All terminal screws backed out, ready to install.
I. In compliance with UL 20.
J. Switches are to be Federal Specification, WC596 compliant. Marking should be clearly identifiable on face or strap.
K. Acceptable Manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, and Leviton.
L. Leviton 5621-2/ 5623-2/ 5624-2, 20 Amp, 120/ 277V ivory, white, black, grey, almond.

2.18 LIGHTED ROCKER SWITCHES - SPECIFICATION GRADE

A. Impact-resistant thermoplastic back body and frame.
B. Cushioned thermoplastic paddle assures smooth, quiet, long-term operation.

C. Unique single rocking butterfly contact provides long term consistent performance with significantly fewer moving parts.
D. Internal back & side wire capability for easy installation with #14 - 10 AWG stranded or solid copper/ copper clad wire. Terminals made of high conductivity brass and serrated for maximum wire gripping.
E. Color-coded back bodies for positive identification of switch rating.
F. Silver alloy contacts integrally formed to the butterfly actuator assures reliable performance.
G. Integral auto-ground clip for positive ground to metal boxes.
H. Brass binding head terminal screws are combination Phillips/ slotted. All terminal screws backed out, ready to install.
I. In compliance with UL 20.
J. Switches are to be Federal Specification, WC596 compliant. Marking should be clearly identifiable on face or strap.
K. Acceptable manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, and Leviton.
L. Leviton 5631-2/ 5633-2/ 5659-2/ 5649-2, 20 Amp 120/ 277V, ivory, white, brown, black, red, grey, or light almond.

2.19 AC MOTOR RATED SWITCH

A. 30 Amp and/ or 40 Amp, 600 V AC rated.
B. Double-pole or triple-pole, single-throw.
C. UL 508, UL 94 (flammability) Listed.
D. All molded parts are made of thermoplastic material to assure superior resistance to repeated impact, chemical degradation, extreme temperature fluctuations, tracking and arcing.
E. Positive-contact design enhances fast make/ slow break mechanism by minimizing bounce and arcing upon contact closure and teasing upon separation.
F. Free-travel toggle design protects closed contacts from accidental disengagement and contact teasing.
G. Silver alloy contacts provide maximum conductivity and prolonged service life.
H. Side and back wire terminal screws accept up to #10 AWG solid copper wire.
I. For standard #8 AWG wire, remove terminal clamp and use ring terminal.
J. Oversized #10, triple-combination, vibration-resistant terminal screws.
K. Mounting yoke is made from nickel-plated brass for superior corrosion resistance.
L. Insulating barriers between terminal screws provide isolation from each phase.
M. Devices are permanently marked with catalog number, Amperage, voltage, and horse-power ratings to assist with identification.
N. Large toggle provides positive actuation, even when operated with gloved hand.
O. Leviton MS302 (30 Amp, 2-Pole), MS 303 (30 Amp, 3-Pole), MS402 (40 Amp, 2-Pole) or MS403 (40 Amp, 3-Pole) or equivalent by Cooper Wiring Devices, Hubbell or Pass & Seymour.

2.20 SURFACE METAL RACEWAY AND WIREWAY

A. Provide surface metal raceway system complete with all fittings, wiring, devices, etc. Surface raceway are to have baked enamel finish.
B. These raceways are permitted only in dry locations where not subject to severe physical damage and must have metal not less than .04” thick. Do not use in hoistways and in any hazardous classified areas.
C. The number, type, and size of conductors permitted in raceway are to be clearly marked on

raceway or on shipping label.

D. Splices and taps may be made providing raceway has an accessible removable cover.

E. Wireway made of 14-gauge sheet metal forming a square trough with hinged cover and complete with couplings, 90° elbows, tees, junction boxes, end plates, and supports may be used for surface wiring at load centers and other locations to the extent permitted by the NEC.

F. Wireways in sizes 2-1/2" x 2-1/2" up to 12" x 12" square may be used; however, no conductor larger than that which the wireway is designed is to be installed therein. Wireway is to not contain more than 30 current carrying conductors at any cross-section and the sum of cross-sectional areas of all contained conductors at any cross-section is to not exceed 20% of the interior cross-sectional area of wireway.

G. Wireways are to be treated with rust resistant primer and finished with gray, baked enamel.

2.21 MC CABLE

A. Type; UL listed Type MC Cable with galvanized steel armor outer casing, color coded circuit conductors, insulated green grounding conductor. Each conductor insulated with thermoplastic insulation.

B. NEC; Article 330, 518 and to comply with Federal Specification J-C-30B.

C. Manufacturers: AFC Cable Systems MC, Alean Cable, BICC, Tamaqua Cable.

2.22 FIRE ALARM MC CABLE

A. Type; UL listed Type MC Cable with galvanized steel armor outer casing, bare grounding conductor, color-coded circuit conductors. Each conductor insulated with thermoplastic insulation.

B. NEC; Article 760 and to comply with Federal Specification J-C-30B.

C. Manufacturer: AFC Cable Systems Fire Alarm Cable or approved equal.

2.23 SECURITY PLATES

A. Receptacle, switch, telephone, and GFCI plates in secure areas are to be made of minimum 14-gauge one piece die formed cold rolled steel.

B. Baked white enamel finish, polyester powder, five-stage pre-treatment, 85% glass, minimum 2H hardness.

C. Back plate 10-gauge prime galvanized steel with four threaded holes. Security screws Torx T-20.

D. U.L. Listed.

E. Manufacturers: Hubbell.

2.24 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Hubbell Lighting.
   2. Leviton Mfg. Company Inc.
   3. Lithonia Lighting; Acuity Lighting Group, Inc.
   4. Novitas, Inc.
   5. RAB Lighting, Inc.
   6. Sensor Switch, Inc.

7. TORK.
8. Watt Stopper (The).
9. Pass & Seymour

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
   1. Operation: Unless otherwise indicated, turn luminaires on when covered area is occupied and off when unoccupied; with a time-delay for turning luminaires off, adjustable over a minimum range of one to 15 minutes.
   2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
   3. Relay Unit: Dry contacts rated for 20 Amp ballast load at 120- and 277-V AC, for 13 Amp tungsten at 120 V AC, and for 1 HP at 120 V AC. Power supply to sensor shall be 24 VDC, 150 mA, Class 2 power source as defined by NFPA 70.
   4. Mounting:
      a. Sensor: Suitable for mounting in any position on a standard outlet box.
      b. Relay: Externally mounted through a 1/2" knockout in a standard electrical enclosure.
      c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
   5. Indicator: LED, to indicate when motion is being detected during testing and normal operation of the sensor.
   6. Bypass Switch: Override the on function in case of sensor failure.
   7. Automatic Light-Level Sensor: Adjustable from 2 - 200 FC; keep luminaires off when selected illuminance level is present.

C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
   1. Detector Sensitivity: Detect occurrences of 0’-6" minimum movement of any portion of a human body that presents a target of not less than 3’-0” square feet.
   2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1,000 square feet when mounted on an 8’-0”" high ceiling.
   3. Detection Coverage (Corridor): Detect occupancy within 90'-0” when mounted on a 10'-0” high ceiling.

D. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
   1. Detector Sensitivity: Detect a person of average size and weight moving not less than 1’-0” in either a horizontal or a vertical manner at an approximate speed of 1’-0” per second.
   2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 square feet when mounted on an 8’-0” high ceiling.
   3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1,000 square feet when mounted on an 8’-0” high ceiling.
   4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2,000 square feet when mounted on an 8’-0” high ceiling.
   5. Detection Coverage (Corridor): Detect occupancy anywhere within 90’-0” when mounted on a 10’-0” high ceiling in a corridor not wider than 14’-0”.

E. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. A particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
   1. Sensitivity Adjustment: Separate for each sensing technology.
   2. Detector Sensitivity: Detect occurrences of 0’-6” minimum movement of any portion

of a human body that presents a target of not less than 3’-0” square feet and detect a person of average size and weight moving not less than 1’-0” in either a horizontal or a vertical manner at an approximate speed of 1’-0” per second.

3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1,000 square feet when mounted on an 8’-0” high ceiling.

PART 3 - EXECUTION

3.01 WIRING DEVICES

A. Lighting outlet boxes to have 3/8” fixture studs.
B. Exterior boxes shall be gasketed and watertight.
C. Switch and device plates to be mounted with all four corners touching adjacent surface.
D. All devices to be installed true and plumb.
E. Switch plates and receptacles shall not be placed back-to-back in adjacent rooms. Offset locations a minimum of 0’-3” to restrict noise transfer. This shall also apply to TV outlets, telephone outlets, data outlets.
F. All devices on opposite side of a fire resistance rated wall assembly are to be separated by a horizontal distance of not less than 2’-0”.
G. Ground-fault circuit-interrupters are to be provided on all outdoor receptacle circuits, receptacle circuits within toilet and bathrooms, areas in close proximity to water, and wherever else indicated on the drawings or required by Code. While-in-use type covers are to be used in exterior wet locations.
H. Tamper resistant receptacles are to be installed in day care areas, pediatric health care, psychiatric care as well as where indicated on the drawings. Refer to NEC 406.12 and 517.18 (C).
I. Arc-fault circuit-interrupters shall be provided on all 15 Amp and 20 Amp receptacle branch circuits in dwelling unit bedrooms.
J. Dimmer switch devices shall be appropriately sized for derating when a minimum of two or more are ganged together in a common wall box.

3.02 WIRING METHODS

A. Exposed interior wiring, panel feeders, home runs, equipment feeders; EMT. EMT conduit shall be securely fastened at intervals not exceeding 10’-0” and within 3'-0” of all boxes. NOTE: Exposed means all wiring which is not installed within walls, above suspended ceilings, or within a pre-manufactured raceway. Any raceway that is to be exposed in a finished area is to be coordinated with the architect/ engineer prior to installation.
B. Concealed branch circuiting above suspended ceilings, and in stud partitions; MC Cable. MC Cable shall be securely fastened at intervals not exceeding 4’-6”, and within 1’-0" of all boxes or fittings. All home runs are to be in EMT.
C. Wiring in concrete slabs or decks is not permitted unless approved by the architect or structural engineer.
D. Exposed exterior wiring; Intermediate rigid conduit.
E. Wiring below concrete slabs in earth; PVC conduit. Provide GRS conduit sweep elbow through concrete slab.
F. Service wiring; PVC conduit encased in 0’-2" of reinforced concrete from utility transformer or

pole to the building (below slab is not required to be encased).

G. Concrete encasement; 0’-2" minimum cover around each conduit requiring encasement. Reinforcement consisting of 4" x 4" No. 4 wire mesh on top level of conduit.

H. Emergency feeder from generator set (if outside building) to building; PVC conduit encased in 0’-2" of concrete, IMC within building.

I. Minimum conduit size is 3/4"Ø.

J. Flexible connections to all motors. Maximum length of flexible conduit is to be 3’-0".

3.03 RACEWAY SYSTEMS

A. All secondary wiring is to be installed in rigid metal conduit, electrical metallic tubing, or MC Cable as specified in these Specifications.

B. Electrical metallic tubing shall be employed in lieu of rigid metal conduit in all locations except:
   1. Underground
   2. In gravel, cinder, concrete, or other sub-base floor construction. PVC may be used under floor.
   3. Horizontal runs in concrete floor slabs. PVC may be used in slabs.
   4. Where subject to possible mechanical injury
   5. In masonry construction below finished grade. PVC may be used.
   6. Vertically in poured concrete walls.
   7. For service work
   8. For main distribution feeders

C. All raceway components shall be fastened at intervals not exceeding 8'-0".
   1. Conduits shall not fasten or come in contact with piping of other trades as installed in this building.
   2. Conduit is to be separated by a distance not less than 0’-6” from any water, steam or gas lines as may be installed in the building.

D. Conduits and raceway systems are not to be run concealed in walls, partitions, and floor slabs. Conduit which must be exposed is to be arranged as to not pass in front of windows, doors, access panels, access doors, sky lights, HVAC equipment access for coil removal or filter removal or required service clearances.

E. Pulling fittings are to be provided for any conduit run which exceeds 200’-0 in length.

F. All high voltage conduits (all conduit serving equipment over 600-volts) are to be painted red and labeled “HIGH VOLTAGE” on 10'-0” intervals. This does not apply to conduit below grade.

G. All exposed fire alarm conduits are to be painted red, unless directed otherwise by the architect. This is to include the 120-volt feed to the control panel. Junction boxes are to be labeled “FIRE ALARM.”

H. All emergency circuits (MC Cable and conduit) are to be painted red unless directed otherwise by the architect. Junction boxes are to be labeled “EMERGENCY 120V.” Appropriate voltage is to be indicated.

I. All conduits and raceway components installed under this Section for completion by others are to be provided with a pull wire affixed at both ends of conduit.

J. Insulating bushings are to be used on all conduit terminations entering enclosures, boxes, and panels to protect the conductor from damage during installation.

3.04 POWER WIRING

A. Wire between motors, starters, disconnects and source.

B. Verify proper motor rotation. Check for smooth operation.
C. Furnish and install weatherproof disconnects, as indicated.
D. All panel feeders are to be run in EMT raceway system.
E. All wiring to roof top units, fans, and HVAC units is to be completely installed between panel, disconnect switches and motor or unit connections.
F. Disconnects are to be mounted adjacent to electrical and mechanical equipment. Indoor installations are to utilize NEMA 1 enclosures. Outdoor installations are to utilize NEMA 3R enclosures.

3.05 GROUNDING

A. All electrical equipment and systems are to be grounded.
B. Grounding system is to consist of a ground bus bar connected to a driven ground rod. Utilize ground type clamp fitting.
C. All connections to conduit, equipment and devices are to be made with compression type connections.
D. The grounding system is to comply with the NEC.
E. All outside luminaires and poles are to be grounded.
F. All equipment and devices are to be grounded in accordance with the manufacturer’s recommendations.
G. The ground system is to have a resistance of 25 ohms or less in compliance with the NEC. Utilize the fall of point method.
H. Furnish a ground system test report at the completion of the work.
I. Substation area grounding is to be in accordance with local utility company standards.

END OF SECTION

SECTION 26 28 16 - SAFETY SWITCHES - GENERAL DUTY

*** Residential, light commercial.**

PART 1 - GENERAL

1.01 REFERENCE

A. Refer to section 26 00 00 for requirements which are applicable to this section.
B. Refer to NFPA and in particular National Electrical Code.
C. Refer to NEMA, UL, and IEEE Standards.

1.02 WORK INCLUDED

A. Provide all labor, material, equipment, and supervision necessary to furnish and install and place into operation safety switches where indicated on the drawings and specified herein.

1.03 SUBMITTALS

A. Submit manufacturer's shop drawings of devices.

1.04 QUALITY ASSURANCE

A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.
B. Install systems and equipment in accordance with the National Electrical Code and local codes having jurisdiction.
C. Provide adequate supervision of labor force to see that installations are correct.

PART 2 - PRODUCTS

2.01 GENERAL DUTY SAFETY SWITCHES

A. APPLICATION DATA
30 Amp-600 Amp
240-volts AC
NEMA 1 - General Purpose, painted sheet steel
NEMA 3R - Rainproof, painted galvanized steel
Standard - Non time delay fuse
Maximum - Time delay (dual element) fuse
B. CONSTRUCTION
Visible blades
Handle attached to box, not cover
Handle position indicates "ON" or "OFF"

Top hinged cover on NEMA 3R
Operating mechanism is quick-make, quick-break
Plated current carrying parts
Provisions for padlocking the switch in the "OFF" position
Class R fuse kits for field installation

C. NEUTRAL AND GROUNDING
Provisions for field installation of insulated, groundable neutral
Ground kits for field installation

D. TERMINALS
UL listed for Al or Cu wires
UL listed for 60°C, or 75°C wires

E. FUSE CLIPS
Spring reinforced
Plated

F. APPLICATION
Fusible - Class H or Class R
Not fusible

G. NEMA STANDARDS
KS1 - 1975

H. UL LISTING
UL 98 Enclosed Switches
Maximum HP ratings

I. UL LISTED SHORT CIRCUIT RATING:
100,000 rms symmetrical amperes with proper rejection kit and Class R fuses 10,000 rms symmetrical amperes with Class H fuses

J. Acceptable Manufacturers:
1. Siemens
2. Cutler Hammer
3. ABB Group
4. Square D

PART 3 - EXECUTION

3.01 SAFETY SWITCHES

A. Furnish and install safety switches on all motors which do not have integral equipment disconnect devices, local starters and/ or where indicated on the drawings.
B. Furnish and install fused safety switches where indicated on the drawings.
C. Safety switches shall be installed to meet the area classification as to standard, hazardous, rainproof, etc.
D. Safety switches shall be installed securely to building structure or be provided with supplemental support steel such as angle iron or uni-strut when required to locate on other than building structure.
E. All safety switches shall be grounded.

END OF SECTION