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616 N. 24th St.
Quincy, IL 62301
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SPECIFICATIONS FOR LABOR AND MATERIALS

for

WASHINGTON STREET GYM HVAC IMPROVEMENTS

at

WASHINGTON STREET GYM
323 W. Washington Street
Macomb, IL 61455

for

MACOMB CUSD NO. 185
323 W. Washington Street
Macomb, IL 61455

MIDDLETON PROJECT NUMBER: 2547 0220
KLINGNER PROJECT NUMBER 21-0155

ISSUE DATE: August 1, 2022

PRE-BID: **Wednesday, August 17, 2022**
Washington Street Gym, Washington Street entrance
9:00 a.m.

SITE VISITS: **Before 3:00 p.m. on school days**
CALL AHEAD to Scott Schauble 309-833-1479..

BID DATE: **Thursday, September 1, 2022 – 2:00 p.m.**
Macomb CUSD No. 185 District Office
323 W. Washington Street
Macomb, IL 61455

PROJECT: Washington Street Gym HVAC Improvements
Macomb Washington Street Gym

FOR: Macomb CUSD No. 185
323 W. Washington St.
Macomb, IL 61455

SUPERINTENDENT OF SCHOOLS: Patrick M. Twomey

ARCHITECT: Middleton Associates Incorporated
1702 W. College Avenue, Suite E
Normal, IL 61761-3028
309/452-1271 FAX 309/454-8049
e-mail: russ@middletonassociates.net
website: www.middletonassociates.net

A/E PROJECT NO: 2547 0220

ISSUE DATE: Monday, August 1, 2022

Drawings Index

DOCUMENT LIABILITY

END 00 0110

Sealed proposals will be received by: Macomb CUSD No. 185

For Project: Washington Street Gym HVAC Improvements
Macomb Washington Street Gym

Proposals to be submitted prior to **2:00 p.m., Central Daylight time, Thursday, September 1, 2022 to the reception desk at the district office**

Macomb CUSD No. 185
323 W. Washington St.
Macomb, IL 61455

Pre-Bid Meeting: **Wednesday August 17 – 9:00 a.m. Washington Street Gym, Washington street entrance.**

Proposals shall be delivered to the above location prior to the time of opening. Proposals shall be identified on the outside of the envelope as "Sealed Proposal" and list the project title as shown above. Immediately following the stated time, proposals will be opened and publicly read.

Terms of the proposal:
- Bid Security is required, 5% Bid Bond payable to Macomb CUSD #185
- Owner protective bonds are required in the amount of 100% of the Contract value.
- Illinois Prevailing Wage Act P.A. 86-799 and Illinois Certified payroll reporting P.A. 094-0515 reported on the IDLR portal.
- Revised Statutes of the Illinois Criminal Code, apply, and including the School Code requirements for contracts.
- No faxed proposals or proposal modifications can be considered.

The Board of Education has the right to reject or accept any or all parts of all bids submitted and to waive any or all irregularities in the bidding and to accept the lowest responsible bid in compliance with the past experience requirements listed in the bid documents.

Plans and specifications prepared by the Architect, Middleton Associates Incorporated, 1702 W. College Avenue, Suite E, Normal, Illinois 61761-2793, Phone 309/452-1271, FAX 309/454-8049. Plans and specifications may be reviewed or printed without charge on line at www.Middletonassociates.net
END 00 1116

1. GENERAL

1.1. QUALIFICATION

A. Competency and responsibility of the Bidder, and of their proposed subcontractors, may be considered in making awards. Determination of responsibility prior to award may include:

1. A detailed statement regarding the business, technical organization, crew availability and evidence of capability for the work that is contemplated.
2. Evidence of successful experience of personnel and previously completed construction projects:

    a. Contractor and personnel, five years or more commercial construction experience, including recent projects of similar or greater value, similarity of types of work, technical content, and complexity.
    b. Evidence that recent projects as described above have been scheduled and delivered on time, aggressively pursued to conclusion without delay.
    c. Experience does not include frivolous claims for additional costs, or work requiring abnormal or extensive corrections.
    d. Evidence that equipment was properly installed and started and functioned without abnormal warranty calls for installation related problems.
    e. Evidence that the contractor coordinated with the Owner, scheduled work in a progressive manner to allow Owner reasonable access to get facilities ready for occupancy in a timely manner.
    f. Evidence that phased projects have been completed without loss of services between phases.

3. Information pertaining to the financial resources of the contractor to pursue the work may be considered prior to making the award:

    a. Evidence of financial resources to cover retainage, meet payrolls, contract for and acquire or pre-pay materials. Resources and Contractor net worth available to this project less than 35% of the contract award may be grounds to disqualify the bid.
    b. Evidence of unpaid bills, unresolved liens, outstanding claims by the Department of labor for wage, benefits or workman compensation violations or failure to provide accurate payroll information.

2. EXAMINATION OF DOCUMENTS, SITE AND WORK INCLUDED

LOCATION OF THE PROJECT: Macomb Washington Street Gym, 323 W. Washington St., Macomb, IL 61455

A. PRE-BID MEETINGS

1. **Pre-Bid Meeting is scheduled for Wednesday, August 17, 2022; 9:00 a.m. Washington Street Gym Main Entrance**
   a. **Electrical work is complex and requires minimum and coordinated shut down to maintain District office operations with minimal disruption.**
   b. **Please have your electrical Sub bidders inspect conditions.**
2. Building may be available for inspection before 3:00 p.m. on school days.
   a. Call ahead to schedule. Scott Schauble 309 833 1479
   b. Exterior work can generally be inspected at any time.

B. EXAMINATION OF SITE AND CONTRACT DOCUMENTS

1. Bidder shall carefully examine bidding documents and inspect the site to obtain first-hand knowledge of existing conditions.
2. Access may not be available on short notice.
3. Do not ask for directions or interpretations of the work during these visits unless in combination with a pre-bid meeting, you may discuss the work but if any clarifications or questions become evident these must be handled through the A/E and no change to the project requirements will result from verbal clarifications of the work during a visit.
4. Each Bidder, by submitting his bid, represents that he has examined the bidding documents, inspected the site and premises, compared task requirements and time constraints to installation conditions and that he understands the obligations of the bidding documents. By providing a proposal he is certifying that he has familiarized himself with the local conditions under which the work is to be performed. Bidders will not be given extra payment or contract time for conditions that could have been determined by on site examination.

C. INTERPRETATION OF DOCUMENTS

1. Anyone having a doubt concerning the meaning of the Contract Documents, or any other questions, may submit a request for interpretation from the Architect/Engineer. All pre-bid interpretation shall be requested not later than FIVE (5) DAYS prior to the bid due date. Response, other than minor clarification, will be in the form of Addenda and will be mailed to each Bidder.
2. It shall be the Architect/Engineer's responsibility to clarify conflicts in requirements as may be reported to the Architect/Engineer. After bid due date, the Architect/Engineer shall determine the course to be followed for said clarification with no cost change to the Owner.

D. ADDENDA

1. Addenda may be issued before the bid opening date to clarify or modify the Contract Documents. Addenda are posted at

www.middletonassociates.net

2. Addenda will be issued electronically. Email address is required to receive addenda.
3. If you have not registered your interest in the bid with the Architect, and do not receive or seek out the addendums then failure to recognize any Addendum may disqualify the bid.
4. Said addenda shall become a part of the Contract documents and supersede any conflicting specifications and/or clarify intent of same.

E. INTENT, ERRORS AND OMISSIONS

1. Any known conflict between requirements of various portions of the Contract Documents shall be reported to the Architect/Engineer prior bid due date and shall fall under the authority of Interpretation of Documents.
2. The Drawings are descriptive and directive in concept and are not intended to exhaust all detail situations required to complete the work. The procedures detailed shall establish the general character of solutions needed for typical, non-typical, and peculiar situations at the job site.
3. It is the intent of the documents that specified work and equipment be installed in a proper and finished manner, fully operational, at a minimum of generally accepted standards for good quality commercial construction. All necessary materials, labor, controls, accessories, brackets, fasteners, sealants, etc., to properly install and complete the work shall be provided unless specifically noted otherwise.
4. Each Contractor and Subcontractor shall coordinate and cooperate with the other Contractors to provide proper installation. Verify dimensions, services, installation conditions, obstacles to the work and modifications necessary to complete the work and coordinate the fit, finish and scheduling of the work.

F. DOCUMENT INTENT, PROJECT COMPLETION, FITTING AND FINISHING FULLY FUNCTIONAL, USER READY

1. It is the intent that all items of work included in the project are to be completely finished and all necessary associated components and accessories for proper completion are to be included in the work.
2. Drawings are schematic in nature; every single element needed is not necessarily labeled, dimensioned or positioned. Unless specifically exempted, the Contractor shall provide as follows:
3. Good quality fit, finish and workmanship at a level of competency and quality equal to or exceeding commercial construction in the area.

    a. Sealants, caulks, flashings, transitions, closures and components to assure infiltration and weather tight result and finished appearance inside and out.
    b. Sealants, flashings, closures at building connections.
    c. Upper and lower flashings, in new construction and whenever possible, to shed water outward.

4. All components and assemblies to assure proper installation and performance of manufactured equipment, per manufacturer's or industry association standards as a minimum.

    a. Mechanical equipment, plumbing, piping, ventilation, valves back checks, connections etc.
    b. Mechanical and electrical coordination, coordination of installation locations, hidden where possible, routed through the construction in the most expedient but concealed manner,

        1) Minor relocation of piping, equipment, installations shall be provided without cost change within 10' either way or reasonable pathways of similar distance.

    c. All other equipment, kitchen, doors, hardware, windows and any other operable equipment
    d. Service access, filters, repairs always allow for reasonable repair and maintenance access.

5. Proper protection of dissimilar materials or components for bond problems, galvanic action, movement, moisture, and/or chemical reaction.
6. New finished appearance for all new work and work abutting existing where applicable.
7. Code compliance:

    a. All equipment and installations.
    b. Electrical NEC, circuit protection, grounding, disconnecting means, GFI, and installation practices
    c. Water, back checks, vacuum breakers, back flow preventers, service valves, hammer arrestors, expansion tanks.

8. Construction assembly details, setting forth special requirements, keyed to a specific section, detail or I.D. number, shall be considered applicable to similar assemblies throughout the contracted work unless specifically designated otherwise.

2.2. DRAWINGS & SPECIFICATIONS

A. OBTAINING INFORMATION

1. Drawings and Specifications may be obtained from the Architect, Middleton Associates Incorporated, 1702 W. College Ave., Suite E, Normal, IL 61761-2793, Telephone 309/452-1271, Fax 309/454-8049.
2. No deposit required for one set subject to return. Contractor may purchase additional documents directly from The Copy Shop in Bloomington.
3. To obtain documents provide the A/E all contact information as well

as an email address for delivery of addendums and bidding information during the bid period.

4. Method of document distribution is at the option of the Owner and the Architect whether it is paper, or digital.
5. Replacement value $60.00.

B. RETURNING DOCUMENTS

1. All documents remain the property of the Architect and shall be promptly returned after the bidding. The low bidder may keep documents and sub bidders may retain same until awards have been made.
2. Failure to return documents within 20 days after bidding will result in loss of deposit or compensation will be required for the replacement cost in the event there was not a plan deposit.

2.3. ALTERNATES

A. The Bidder shall submit a proposal for every alternate listed in the Contract Documents. Failure to provide alternate prices may disqualify the bid.

B. See Section 00 24 13, Scope of Bids, for a description of Alternates.

2.4. BID SECURITY

A. The Bidder shall furnish bid security, along with his proposal:

1. Form of security to be bid bond or certified check payable to the Owner.
2. Amount 5% of the base bid proposal
3. Said security shall serve as a guarantee that the Contractor will enter into the Contract with the Owner as per his bid and the contract terms should the job be awarded to him.

B. Should said Contractor refuse or fail to enter into a Contract with Owner per his bid for the work included in these Contract Documents within fifteen days following notification of award and/or receipt of a contract for signature, said bid security shall become collectible, in full, by the Owner in payment for damages.

1. Failure to enter into an agreement shall mean failure to return or submit:

a. A signed agreement.
b. Owner’s protective bond(s) for Labor, materials and performance.
c. Approved subcontractor/supplier lists.
d. Certificates of insurance within stated time period.
e. Evidence that this contractor intends to pursue this contract in a timely and deliberate manner, including ordering of materials and committing or arranging for necessary manpower to accomplish the work.

2.5. WITHDRAWAL OF BIDS

A. Bids may be withdrawn by an authorized person prior to the bid due date and time, after which time no bids may be withdrawn for a period of forty-five (45) days unless a Bidder has been released by the Owner's action.

B. Authorized person shall mean an Owner or Officer of the Contractor offering the proposal or other evidence of authority.

2.6. PROPOSAL (BID) FORMS

A. Each bidder shall submit his proposal, on proposal form provided.

1. Submitted bid forms may be copied
2. All applicable blank spaces on forms shall be filled out fully.
3. Numbers shall be stated in writing where noted and in figures.
4. Signatures shall be live in longhand by person authorized to sign bids as Owner or corporate officer or shall include Power of Attorney to sign the bid.
5. No facsimile proposals or modifications can be considered per Illinois School Code on public school projects.

B. Completed forms shall be without delineation, clarification, alteration or modification.

1. Correction of contractor inserted is acceptable if clearly identified and initialed by the signatory to the bid. Irregularities of such corrections may be grounds to disqualify the bid.
2. Offers to clarify or modify may be made on voluntary alternates and substitution forms if provided in the bid package, but in no case should the base bid or requested alternate bids offered be based on anything but the document requirements.

C. Voluntary alternates or offers for substitutions may be attached on forms provided or on the bidder’s letterhead. These will be considered at the Owners option. Additional information may be requested prior to consideration.

2.7. AWARD OF REJECTION OF BIDS

A. Although it is the intention of the Owner to accept the lowest qualified bid the Owner specifically reserves the right to waive all formalities and/or informalities, to reject any and all bids and/or accept the bid that, in the Owner's judgment is the lowest responsible bid.

B. Contractor will note all alternates that are applicable, or as may become applicable by addendum, should be bid. Failure to bid an alternate may be grounds to disqualify the proposal, at the Owners discretion.

C. Should the time for award exceed the time stated for the proposal’s expiration period, the Owner reserves the right to continue to negotiate with bidders in the line of award succession as a prior option rather than re-bid.

2.8. RETURN OF BID SECURITY

A. After bids have been read along with alternates as applicable and a successful Bidder has been approved by Owner, a Letter of Intent will be sent to the successful bidder and bid security may be returned to the unsuccessful bidders except the deposits of the two (2) most advantageous bidders will be retained until Owner/Contractor agreements have been consummated.

B. Following the signing of the Contracts and receipt of bonds, remaining bid security will be returned. If the successful Bidder fails to accept the Contract and submit acceptable bonds, same will be grounds for forfeiture of his bid security.

2.9. OWNER'S PROTECTIVE BONDS: A 100% of value Labor and Material Payment Bond and Performance Bond including all alternates accepted is required in the Contract and shall be included in the Contractor's Proposal:

A. Periodic Change Orders that may occur to the Contract shall be included in each respective bond.

B. Bonds shall cover the entire Contract without regard to the Contractor's assignment of work of Subcontractors or Suppliers.

1. Inclusive of all awarded Alternates.

2.10. AWARD AND LETTER OF INTENT

A. The Owner will make an award based on the selection of the lowest cost responsible bidder. After the award, and the issuance of a Letter of Intent, the contract timeline is as follows:

1. Return signed agreement (10) days
2. Sub Contractor, Supplier list, including any entity to be assigned a significant or skilled trade part of the work, provide list, addresses and contact information, (7) days. Provide references upon request.
3. Labor and Materials Payment, and Performance bond(s), ten (10) days
4. Insurance, ten (10) days
5. Master Cost Breakdown (CSV), ten (10) days
6. Proposed Schedule and time line, Pre-Construction meeting

B. Failure or refusal to provide the preceding Contract information in a timely manner may be cause for cancellation of the award or termination of the agreement if signed and the Owner will be entitled to compensation under the terms of the bid security for failure to execute contract terms in good faith.

2.11. LIST OF SUBCONTRACTORS AND SUPPLIERS

A. Within seven (7) business days after notification of intent to award, and prior to the Contract being signed, the Contractor shall submit to the

Architect/Engineer, a list of proposed subcontractors and major equipment suppliers and other persons or organizations to be assigned part(s) of the contract.

B. This list is subject to the review and approval of the Owner. Basis for this review may include supporting evidence the proposed Subcontractor or Supplier has experience and adequate resources to accomplish the assigned responsibilities on time and in compliance with the requirements.

1. The Owner reserves the right to request justifiable changes in the list.
2. The changes requested are intended to be made at no additional cost to the Owner.
3. If it is not possible to make requested changes at no additional cost, the Owner reserves the right to terminate the award and negotiate with the next successive bidder based on his original proposal.

2.12. MATERIALS SPECIFIED AND QUALITY OF WORK

A. Materials shall be as specified or approved equal.

1. Approved equal" and "or equal" shall mean that the Contractor shall be required to receive the approval (via the Architect) on any substitute materials.
2. Requests for substitution approval shall be submitted to the Architect/Engineer, seven (7) days prior to the bid due date.
3. Prior to considering substitutions, the Owner and/or the Architect/Engineer may require submission of samples, descriptive, technical and catalog data and lab reports of tests for verification of equivalency.
4. If approved and selected, all adaptations to fit and accommodate the substitute or equal equipment including coordinating other trades is the responsibility of the Contractor requesting the change.

2.13. PROGRESS PAYMENTS

A. Will be made not more frequently than monthly, per the Owners payment schedule.

2.14. PROJECT ACCESS: The Contractor shall be aware that the Town/City, Township, County or State has authority over various approach roads for site access and the Contractor is responsible to:

A. Observe load limits and arrange for any exceptions to load restrictions that may be required for this project.

B. Make arrangements for road cleanup, barricades and surface patches and repairs shall comply with applicable regulations and be subject to the governing authority approval.

2.15. EQUAL OPPORTUNITY EMPLOYMENT: The following clause is applicable unless this Contract is exempt under the rules and regulations of the Secretary of Labor of the State of Illinois.

A. During the Performance of this Contract, the Contractor agrees as follows:

1. The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, age or national origin. The Contractor will take affirmative action to ensure that all applicants are considered and that employees are treated, during employment, without regard to their race, color, religion, sex, age or national origin."

2.16. ILLINOIS STEEL PROCUREMENT ACT

A. During the performance of this contract, the contractor agrees to:

1. Comply with the 30 ILCS 565
2. Steel products used or supplied in the performance of that contract or any subcontract thereto shall be manufactured or produced in the United States.
3. All requirements of and/or exemptions allowed in this regulation apply without exception.
4. The Owner and A/E cannot interpret the legal requirements as applicable to this contract.
5. Any additional cost incurred by the Owner for a violation of this provision shall be reimbursed by the Contractor.
6. If the regulation cannot be complied with due to product or inadvertent specification requirement, notify the A/E promptly for direction.

2.17. ILLINOIS DEPARTMENT OF LABOR AND LABOR RELATED REQUIREMENTS

A. IDLR regulations apply to all work on site without exception.

B. Publicly funded projects or projects managed by Public Bodies require the following:

1. PREVAILING WAGE 820 ILCS 130/4: The Contractor shall pay and shall require his subcontractors to pay the prevailing hourly wages as is determined by the Illinois Department of Labor pursuant to the Illinois Prevailing Wage (820 ILCS 130/1 et. seq.) included at the end of this section.
2. CERTIFIED PAYROLL REPORTS: Will be required with each successive pay application for payroll periods preceding the application date.
3. SUBSTANCE ABUSE PREVENTION ON PUBLIC WORKS 820 ILCS 265: All Contractors must be prepared to certify upon request that they have complied with the Illinois Substance Abuse Act, including a written program that meets or exceeds the requirements of this act for the prevention of substance abuse among its employees.

2.18. SALES TAX

A. Materials supplied to a public school district are exempt from state sales

taxes. The Contractor shall determine the extent of exemption and shall comply with the regulations established by the Illinois Department of Revenue.

2.19. TOBACCO AND ALCOHOL FOR CONSUMPTION PRODUCTS

A. Smoking, chewing, tobacco use; shall not be permitted anywhere on public school property by State Statute.

B. Alcoholic beverages, controlled substances, unauthorized prescription medication are not allowed on school property.

1. Working under the influence of any of the above and/or a legal prescription that causes impairment is not allowed.

C. Violators may be removed from the job sites subject to conditional return privileges in the future.

2.20. SEXUAL HARASSMENT POLICY

A. The Owner will not tolerate sexual harassment in any form. Sexual harassment is defined, for the purpose of this policy, as "unsolicited, deliberate or repeated sexually derogatory statements, gestures or physical or implied physical contact that causes discomfort or humiliation. Sexual harassment may involve pressure from a person of either sex against a person of the opposite sex or same sex . . ."

1. Should evidence that a Contractor, or a Contractor's employee, has harassed staff, student or other individuals, that employee shall be removed from the job site permanently or until such time that the circumstances have been determined to have been resolved satisfactorily.

2.21. BACKGROUND INVESTIGATION AND SEX OFFENDERS ON SCHOOL GROUNDS

A. Illinois Criminal Background checks may be applicable to this Contract. per 105 ILCS 5/10-21.9 and 105 ILCS 5/14-7.02.

1. According to current interpretation a background check is only required of persons working in direct contact with students.
2. This standard in no way reduces or eliminates restriction in the law for certain convictions and proximity to school grounds.

B. The Contractor shall:

1. Maintain a list available to the Owner of all the employees who will be or are anticipated will be employed on site. This list shall be updated when new persons not originally listed will be working on site. This list shall also include names of personnel employed by subcontractors.
2. Persons temporarily on site such as truck drivers or employees making deliveries do not need to be listed, but the Owner reserves

the right to request a background check if deemed in their interest.

3. Copies of employee lists shall be promptly provided to the Owner upon request and employees on site shall agree to submit to a background check if requested.
4. Persons failing such check or refusing shall be removed from working on this site.

C. The Contractor shall not knowingly employ on school grounds any person who has not signed or will not sign an authorization for a criminal background check.

D. The Owner reserves the right to run fingerprint background checks on any or all employees on site, randomly or specifically, and the cost of this check will be borne by the Owner. Upon request, provide information, which will not be shared, as needed to complete checks. This may include SSN, home addresses, fingerprint, address, etc. and any alias or former names used.

E. The Contractor shall assume the responsibility to notify all on site employees or potential employees of this provision, and of the consequences of this provision.

2.22. BUILDING PERMITS

A. This project is exempt from local permit fees associated with the construction. Any such fees assessed are reimbursable.

1. This Contractor shall fully cooperate with the local authorities and shall apply for and obtain all required permits and comply with local regulations and requirements. Only the fee is exempt.
2. Provide necessary permit related information to local city authorities.

2.23. CONTRACT DOCUMENTS CHECK LIST

A. Proposal

1. Proposal Form properly filled out and signed, (live signatures)
2. Bid Bond/Bid Security for 5% of base bid amount (live signatures)
3. Low bidders exempt, return of documents within fifteen (15) working days after bid due date

B. Letter of Intent

1. Supplier - Subcontractors List, (10 days after Award)
2. Employee list and criminal background affidavit, (prior to start on site.)
3. Proposal & Contract Form prepared by the Architect, (signed and returned 10 days after receipt).
4. Labor and Material Payment Bond, two copies (10 days after award)
5. Performance Bond, two copies (10 days after Award)
6. Insurance Certificates, liability and hold harmless, three copies (10

days after award) *
7. CSV - Master Cost Breakdown (Preconstruction meeting)
8. Bar Graph/Progress Schedule, copies as required (Preconstruction meeting)

C. Periodically as needed

1. Update employee list and criminal background affidavit as needed.

D. Periodic Application for Payment

1. Submit per the monthly scheduling, to be determined
2. Application and Certificate for Payment, 3 copies (AIA G702A)
3. Contractor's Affidavit, 2 copies (AIA G706)
4. Breakdown Estimate, 3 copies
5. Partial Waivers of Lien, 2 copies

   a. Partial Waiver of Lien from Subcontractors/Suppliers for previous payment, 2 copies.
   b. Updated Progress Schedule, submit with each pay request

6. Certified Payroll for all trades employed on site.

E. Substantial Completion

1. Notification work is ready for inspection.
2. List of deficiencies or incomplete work.

F. Final Application for Payment:

1. Letter to Architect that deficiency work is complete
2. Final Lien Waiver from the Contractor, 2 copies
3. Final Lien Waivers from Subcontractors/Suppliers, 2 copies
4. Final Affidavit showing $0.00 due to Subcontractors and $0.00 due to Suppliers, 2 copies
5. Final Payment Approval Letter from Bonding Co., 2 copies
6. Certification of all guarantees, warrantees and service contracts, O & M Manual
7. Final Application & Certificate for Payment, 3 copies (AIA G702A)
8. Additional certifications as may be requested, 2 copies
9. Operating manuals & instructions, 3 copies-indexed and bound
10. Figure Bonus / Penalty and Liquidated Damages if applicable.

G. IDOL Prevailing wages see IDOL website.

1. http://www.illinois.gov/idol/Laws-Rules/CONMED/Pages/prevailing-wage-rates.aspx

END 00 2113

1. GENERAL

1.1. DESCRIPTION OF DRAWINGS AND LAYOUT

A. Drawing data is intended to be reasonably accurate, however, strict accuracy in detail is not guaranteed.

1. Drawings, particularly Mechanical and Electrical drawings are schematic in nature.
2. The Contractor must verify all of the actual conditions, measurements, dimensions, rough-in requirements; fitting of piping, conduit, wiring, and duct work and coordination necessary for each item, system or piece of equipment in the Contract Documents.
3. Verification is the Contractor's responsibility and shall be completed prior to the fabrication or installation processes.
4. Coordination of all elements of the work must be allowed for with cooperation between the trades particularly for conflicts of limited flexibility of installation. The general priority unless fixed conditions conflict is as follows: structure, placement of equipment, service access, mechanical piping, plumbing piping, and electrical piping. Trade priority in the preceding list does not supersede field cooperation to collectively and most expediently install the work.
5. All corrections necessary to provide properly installed, finished and operable system, in accordance with the intent of the Documents, shall be made at no additional cost.

B. All measurements and conditions must be verified by actual observation at the site.

1. The Contractor shall be responsible for all of his work fitting into place in a satisfactory and workmanlike manner in every aspect and detail subject to the approval of the Architect. The Contractor shall provide layout work and verification measurement at his own cost.
2. The Contractor shall perform all layout work pursuant to site, building, grades and levels, and furnish such engineering services as he may require executing the intent of the work included.

C. Before starting his work, the Contractor shall examine all Contract Area Drawings and Specifications and if discrepancies or conflicts are apparent or occur during the progress of the work:

1. Work first with the conflicting trades or installations to fit and coordinate the work.
2. If there appear to be no practical or agreeable way to coordinate the fitting of the work report same to the Architect as a Request for Instruction, RFI, and obtain direction or interpretation to proceed.

D. The Drawings are instructive and diagrammatic and shall be followed as closely as actual construction will permit. All changes from Drawings necessary to complete the work shall be done at no added cost charge to

the Owner above the amount shown on the Owner/Contractor Agreement.

1.2. OVERLOADING OF BUILDING

A. Care shall be taken that completed structures are not overloaded during Contractor operations. It shall not be the Owner's, or Architect/Engineer's responsibility to observe and check construction processes and temporary loading conditions that may temporarily occur in the pursuit of the completed installations.

1. Structural design, unless noted otherwise, is designed to accommodate design loads, per code, after completion.
2. Bracing and shoring for loading or stability prior to the installation of lateral support elements and diaphragm assemblies is the responsibility of the Contractor.
3. All structural damage done by overloading the system shall be repaired by the Contractor or Subcontractor overloading the system.

1.3. MEANS AND METHODS

A. The Architect/Engineer and Owner shall have no authority over the means, methods and procedures of the work and shall make no determination pursuant thereto nor render opinions concerning same.

1. The Architect’s Field Representative does not have authority to render opinions on structural questions.
2. If questions arise submit a Request for Information, RFI, for direction.

B. The Architect/Engineer and Owner and representatives of same shall have no authority over methods employed or safety conditions related to:

1. Erection loads and as they relate to the Contractor’s interest and shall provide no observation of same.
2. Upon request the Architect can provide the design loads employed for the final installation.
3. The contractor shall designate an employee of the contractor as the person in charge of and responsible for directing the work and safety procedures on site.

1.4. PROTECTION OF WORK AND BUILDING

A. The Contractor shall protect all work and stored materials from injury or loss caused by or resulting from operations under this Contract, including but not limited to:

1. Physical damage

a. Poor stacking practices
b. Abuse damage due to adjacent operations or exposures
c. Weather related damage

2. Failure to have reasonably secured stored and in progress work.

1.5. MOVING OF MATERIAL

A. Contractor materials which are temporarily located or stored shall be relocated as needed to allow access by the Contractor, other Contractors and the Owner's personnel in and around the construction area.

1. Prior to storing materials coordinate the operations to avoid conflicts.
2. Such moving of any material shall be at no additional cost to the Owner.

B. At no time shall tools, materials or workmen block an exit unless same has been coordinated with other trades on site and reasonable alternative options are maintained.

1.6. SHORING, BRACING, AND BARRICADES

A. The Contractor shall provide, construct and finally remove all temporary shoring, bracing, underpinning, scaffolding, needling, barricades, etc. as required by local restrictions and as necessary for to protect persons and property from damage or injury.

1. The Contractor shall determine the need for these items.
2. The Contractor shall be responsible for the performance or failure of performance of same and shall repair damages caused by failure or absence of same.

B. Specific temporary shoring supports, etc., may be noted in the Documents, such as for new openings or certain renovations in existing work.

1. All such needed shoring is always not noted but the responsibility of the Contractor or Sub Contractor making the opening or installing the new work as needed
2. Notation on the drawings is an observation that existing support conditions are being impacted by the work and shall be attended to by the Contractor as needed by conditions discovered.
3. In all cases, observe actual conditions of the work, same may be different than the anticipated conditions and may require shoring bracing and barricades.

1.7. MATERIALS, WORKMANSHIP, AND LABOR

A. All installed materials and equipment shall be new and shall be installed and completed in a first class, workmanlike manner.

B. The Architect reserves the right to direct the removal and the replacement of any item which, in his opinion, does not present a proper, orderly or reasonably neat installation. Such removal and replacement shall be done promptly when directed by the Architect or the Owner. All installations will

be subject to the Architect's and Owner's inspections, tests, and approval at all times from commencement of the work to Final Acceptance of the completed Contract.

C. Work needing correction or replacement that is not corrected with reasonable promptness shall be subject to written notice thereof by the Architect. The Contractor by virtue of having tendered his bid for the work, agrees that progress payments by the Owner may be held (no payment made) until said faults have been corrected.

1.8. ALIGNMENT BALANCING

A. The Contractor shall be responsible for supervision of the installation of equipment.

1. Level, adjust, balance and align new equipment and reinstalled or relocated equipment.
2. Provide all alignment per manufacturer set up recommendations, align and balance pumps, belts and pulleys and adjust equipment to work properly.

1.9. CLEANING

A. Work areas shall be maintained reasonably clear of accumulated debris, cartons and unused equipment to allow orderly pursuit of the Work.

B. All surfaces shall be cleaned of any paint, plaster, mortar, gook and other stains.

1. Care shall be taken that no surface is scratched, marred or damaged by the cleaning process.
2. Damaged, marred or scratched surfaces of any type shall be repaired to new or original condition or replaced if necessary to provide a final installation acceptable to the Architect.

C. Final Cleaning - All areas new and renovated areas:

1. Clean and dusted.
2. Floors cleaned ready for occupancy.
3. Marks and scuffs repaired.

1.10. OPENINGS IN CONSTRUCTION

A. Openings required for construction work shall be provided by the Contractor, complete with all necessary reinforcing, lintels, trim, finishing, etc. as shall be needed to complete the Work including openings required for electrical and mechanical work.

1. Openings to be provided for other trades must be laid out and noted by the trade needing same prior to construction of the surface through which the opening is needed.

2. Untimely note of required openings shall be the responsibility of the Contractor or Subcontractor not requesting same.
3. All sleeves, flanges and forms, etc., shall be furnished by the Contractor requiring the opening.

B. Concrete slabs, joists, concrete floors, finished floors, walls and structural elements, and other structural items shall not be cut or disturbed, except as approved by the Architect IN WRITING.

C. Pipes or elements passing through floors or partitions shall have sufficient clearance around pipes to prevent damage to the adjacent finish from expansion and contraction.

1.11. FIRE SEALS

A. All penetrations of fire walls, smoke barriers and floors shall be properly fire sealed to prevent the passage of smoke and maintain the integrity of fire barriers.

1. Such seals are the responsibility of the contractor for whom the penetration is provided.

1.12. SUPPORTS

A. The Contractor shall provide all concrete, steel bases and anchorage except as herein specified otherwise: vibration absorbing foundation bases, hangers, platforms, anchor bolts, etc. for all equipment which he furnishes. These foundations or supports shall be as specified under their respective headings, as shown on the drawings and/or as recommended by manufacturers.

1. Materials and installation requirements for curbs and pads shall be commensurate with the need.
2. Concrete shall be 3500 psi minimum strength, air entrained 5% to 8% by volume. Install following commercial practices.
3. Framed curbs or foundations shall be properly supported.

1.13. PROTECTION OF WORK

A. The Contractor shall protect his work and adjacent existing work from injury by keeping all piping, ductwork, etc. capped, plugged, drained, or otherwise protected from injury including damage done by freezing and damage from building materials, cement and/or dirt, concrete traffic or exposure.

1.14. ELECTRICAL SERVICES TO EQUIPMENT

A. Unless otherwise specified the Contractor shall furnish and install electrical feeders of proper size, and furnish, install and complete all power wiring and the control wiring for each motor, electrified signage and/or piece of equipment affected by the Contract.

1. Although circuits may be called for on the drawings, ALWAYS verify the final equipment requirements before pulling wire in the event it needs to be increased in size.
2. Contractors providing equipment shall verify the circuits and protection level and need for safety switches matches what they are providing.

B. All electrical procedures shall comply with the National Electric Code, whether temporary or permanent.

1.15. SEALANTS

A. Provide sealants in all locations where shown on the Drawings or called for in the Specifications and as necessary for infiltration tight and weather tight building envelope and finished visual appearance.

B. Sealants shall be provided in locations as directed by the Architect, where equipment components or fixtures fit to surrounds, and when cracks between equipment and surrounds are undesirable or excessive. Provide sealants in all interior locations, as necessary to properly trim out.

C. Sealants shall be installed and tooled in strict accordance with the Sealant Manufacturer's recommendations for joint preparation, using foam rope backer bars, etc. Sealant shall be installed by the respective Contractor providing the item requiring sealant installation.

1.16. PAINTING

A. All exposed surfaces or equipment reworked and installations leaving damaged or unfinished surfaces shall be painted or have a corrosion resistant or factory applied finish.

1. Unfinished non ferrous metals such as aluminum and stainless steel do not require painting.
2. Field paint unfinished equipment and surfaces for corrosion protection and visual appearance, except where clearly stated to the contrary on the Drawings.

END 00 2213

1. BASE BID

1.1. DESCRIPTION

A. The Base Bid is to provide the Owner with all materials equipment and labor to complete the specified contract work.

1. All work is a single Contract, Macomb Washington Street Gym, 323 W. Washington St., Macomb, IL 61455.
2. The Base Bid proposal must be for the specified work and as may be modified prior to the bid time and date by addendum.

    a. Do not add any additional description of what is included or excluded from the bid on the proposal form, this may disqualify the bid.
    b. Fully fill out the proposal/bid form, omissions and failure to sign will disqualify the bid. Minor irregularities in filling out the bid form may be considered by the Owner as inconsequential to the intended bid and may be declared as such and the bid be accepted.

3. Voluntary Alternates or Substitutions may be offered on the Voluntary alternate and substitution form if provided or on the Contractor's letterhead if desired. Such options should not materially change the intent of the proposal. These may be considered or disregarded at the Owner's discretion without explanation.

4. This facility is occupied after normal school hours. All work shall be completed affecting use of the gym floor shall be completed prior to 3:00 p.m. and the floor be made available for practice. Games may also be scheduled and these will be coordinated with the contractor such that bleacher seating will be available to the public.

B. Work; as noted on plans and including but not limited to

1. Washington Street Gym, includes but not limited to:

    a. Demolition associated with new and renovation work
    b. Install new ground mount roof top units and extend insulation weather tight ductwork into the existing facility
    c. New duct work across the gym.
    d. And replace ground set transformers and transformer pads as directed by Ameren for new service.
    Coordinate with new mounting conditions,
    e. New rough in and wiring as need to complete the work.
    f. Coordinate and schedule work to minimize down time

    .

        a. Schedule as possible for Weekends if possible.

g. Coordinate with owner before scheduling any shut down. Minimum 14 days notice please.

h. Support pads raceways wiring, duct work sealants patching repairs etc.

1) Carpentry work.
2) Roofing and flashing work
3) Repair all impacted surfaces and surrounds, weather tight and attractive result.

h. Edison School, includes but not limited to:

1) Demolition associated with replacement and renovation work
2) Replace auditorium seating.

i. New work and equipment as specified in the Documents

1.2. UNIT PRICES

A. None unless requested by addendum

1.3. ALLOWANCES

A. **Include an allowance of:**

1. **$10,000** for unexpected conditions or scope added by owner. Excess to be refunded, – assignment by agreed change order with the Owner.
2. **$0.00 for the Ameren fees for the new service.**

1.4. ALTERNATE BIDS

None requested unless identified in an addendum. Space is provided on bid form for any such alternate requested by addendum.

END 00 241

1. GENERAL

1.1. SCHEDULING

A. Master Schedule

1. The General/HVAC Contractor as the Coordinating/Pacesetting Contractor shall maintain a Master Schedule.
2. Prior to preparation of the Master Schedule, all Subcontractors shall coordinate scheduling needs with the General Contractor.
3. Upon preparation of a detailed schedule, same shall be reviewed by the Architect and the Owner. Once accepted, it shall become the basis for determining the on time progress of the work.

    a. Provide manpower, overtime, and equipment as needed to maintain the schedule. The Owner will not authorize additional payment for overtime or additional manpower needed to maintain, achieve, or make up time to meet the schedule.
    b. The General Contractor shall notify the Architect and the Owner promptly of any deficiency in performance, which is unacceptably impacting the schedule or delaying progress.
    c. The Subcontractor(s) shall immediately notify the General Contractor, in the event any trade area Contractor's progress is impeding their ability to maintain the schedule.
    d. The General Contractor shall immediately provide notification of this report to the Architect and the Owner and shall include a plan of action to regain schedule.

B. Schedule

1. Contractors proposed schedule and timeline shall be delivered for review at the Pre-construction meeting.

    a. Schedule will be subject to review and negotiated revision after Owner and Architect input are considered.
    b. Contractor schedule should be available for the Preconstruction meeting.
    c. We recognize schedule to be developed will be dependent upon equipment delivery.

2. Submittals shall be delivered forty-five (45) days following award.

    a. This schedule is adjustable shorter or longer depending on the size and content of the project

3. Upon receipt of review submittals, schedule material and equipment for delivery by early June.

4. Confirm that manpower is available and Contractor has adequate capacity to complete the work on a timely basis.

    a. Materials and equipment may be stored on site in trailers or in suitable insured warehouses in or near Lincoln.
    b. Materials and equipment delivered on site or suitably stored with proof of insurance may be submitted for payment, subject to inspection.
    c. The Owner requests that equipment and materials to do the work be on site or readily available for delivery prior to the start of operations.

5. Schedule

    a. Project is planned for execution fall 2022 the schedule to be coordinated with the Owners schedule and in an orderly fashion.

        1) **Once operations begin, the site shall be manned through completion.**
            a) We recognize this may be a two stage operation with electrical separate schedule from the HVAC work.
            b) But man each trade continually once major operations commence.
            c) Transformers
                (1) Schedule minimum down time, with the owner,
                (2) work weekends or second shift if possible.
        2)
            Final completion of deficiency items May1, 2023

        3) Work shall be scheduled to be occur before 3 p.m. daily with gym floor cleaned up and ready for athletic team practices or games after school.

    b. Cooperation, always include in your schedule for manning the work and planning completion, not less than five days of flex time for summer tasks in the event the coordination, delivery issues or unusual weather impact on the work or unexpected Owner occupancy issues occur which might impact access. This is over and above the allowances you might include for your own operations such as weather, vacations, delays in delivery materials or equipment and illness. There is no intent or expectation of the Owner to abuse this allowance and every intent to cooperate to get the work complete, but an unexpected or uncontrollable time impact prior to August will not change owner

occupancy schedules.

c. It is intended all work to be complete and fully operational at substantial completion, and final complete 10 days after receipt of substantial completion punch list.

d. See requirements for Manning the work described hereafter.

e. The owner desires to get as much work as possible done early in the summer; work must be coordinated with building personnel for stripping, waxing and other summer maintenance work.

C. Manning the work

1. Contractors shall work overtime, Saturdays and/or double shifts if work falls one (1) week behind prepared schedule or agreed to revision and shall continue to work Saturdays and double shifts, full crews or with additional crews until lost time is recovered.
2. Prepare a plan of action to recoup lost time for the A/E and Owner.
3. See also the additional instruction on power outages in 1.1.B.5 above.

End 00 3000

PROJECT TITLE: Washington Street Gym HVAC Improvements
at
Macomb Washington Street Gym

DATE OF PROPOSAL **Thursday, September 1, 2022** - TIME: **2:00 p.m. Central Daylight time**

LOCATION OF BID: SUPERINTENDENT'S OFFICE
Macomb CUSD No. 185
323 W. Washington St.
Macomb, IL 61455

NAME OF FIRM _____

PROPOSAL FOR: All work single contract

A/E PROJECT NO. 2547 0220

THE BID ACKNOWLEDGES THE FOLLOWING ADDENDA:
Failure to acknowledge may cause bid rejection

NO. 1 _____, NO. 2 _____ , NO. 3_____, NO. 4_____, NO. 5 _____

EACH BID SHALL INCLUDE:

A. The bid forms and certifications completed and signed, (*this form may be copied.)*
B. Bid security (*standard industry forms may be employed)*
C. Bids shall include **$10,000.00 ALLOWANCE** – See Specification 00 2413
D. The bidder shall be aware of the need to minimize down time for the electrical renovations and coordinate with the owner, and work evenings or weekends to complete.
E. Ameren Fee $0.00

BASE BID: **Washington Street Gym HVAC Improvements:** The bidder agrees to perform all base bid work, single general/HVAC contract, inclusive of all trades for the sum of:

_____**Dollars**
WRITTEN AMOUNT

$_____
NUMERICAL

ALTERNATE _____
SPACE LEFT FOR ALTERNATE IF REQUESTED BY ADDENDUM

_____**ADD/Deduct$**_____

Schedule: anticipated weeks to deliver equipment after submittal review:_____

VOLUNTARY ALTERNATES OR SUBSTITUTIONS

Did you offer or include any voluntary alternates or product substitution on form provided.

YES _____ **NO** _____

SEE PRODUCT SUBSTITUTION OR VOLUNTARY ALTERNATES FORM, ATTACH IF ANY ARE OFFERED. Voluntary alternates or substitutions may or may not be considered in making the award and are not required.

THE BIDDER AGREES TO:

1. Hold this bid open for thirty (30) calendar days after bid opening date.
2. Enter into and execute a contract with Macomb CUSD No. 185 if awarded this contract.
3. Comply with the contract and bidding documents with respect to bid security, all bonds, insurance, work requirements, schedule and Bonus / Penalty Clause
4. Comply with the Contract Documents with respect to scheduling as described in the documents, noted on drawings.
5. Follow the schedule proposed in Project Schedule specification 00 3000

THE BIDDER MAKES THE FOLLOWING REPRESENTATIONS AND CERTIFICATIONS:

A. A surety company has agreed to issue payment and performance bonds to fulfill the contracting requirements.
B. The Bidder is not barred from contracting with any unit of state or local government as a result of violating the bid rigging or bid rotating provisions contained in 720 ILCS 5/33E.
C. The Bidder is not barred from contracting with the State of Illinois as a result of a bribery conviction per 30 ILCS 505/10.2.
D. All on site labor and wage compensation provided by this contractor or his subcontractors will comply with the Illinois Prevailing Wage Act (820 ILCS 130E).
E. This proposal is made without any connection with any person making another bid for the same contract, that the School Board, other officer or any person in the employment of Macomb CUSD No. 185 is directly or indirectly interested in the bid or any portion of the profit there from, except as allowed by the Illinois Law or the Illinois School Code.
F. I agree to provide a drug-free workplace as required by the Illinois Drug-free Workplace Act.
H. I do hereby certify that I am either the bidder or duly authorized agent of the referenced bidder, and I am authorized to execute the certifications hereon.
G. I certify that by submission of this proposal the bidder confirms that he is familiar with the site, existing conditions, the Bid Documents, requirements and the project schedule.

CONTRACTOR:

Firm Name: _____

Address: _____

_____

Telephone: _____

FAX: _____

Email:_____

Date: _____

END 00 4000

SIGNATURE:

_____

TITLE: _____ _____

For Corporations only

The Bidder should include this form with the Bid Forms if a material substitution is offered at that time.

The Base Bid and Alternate Bids include only those products specified in the bidding documents. Following is a list of substitute products which bidder proposes to furnish on this project, with the difference in price being added to or deducted from the Base Bid or Alternate Bids.

Bidder understands that acceptance of any proposed substitution is at Owner's option. Approval or rejection of any substitutions listed below will be subject to review after Contract award. Hold open for thirty-five (35) days from Bid Date.

SUBSTITUTIONS

MANUFACTURER'S NAME AND PRODUCT	ADD OR (DEDUCT)
_____	_____
_____	_____
_____	_____
_____	_____

VOLUNTARY ALTERNATE

DESCRIPTION	ADD OR (DEDUCT)
_____	_____
_____	_____
_____	_____
_____	_____

EVALUATION. Contract award will be made in accord with Instructions To Bidders. Only the lowest responsible bidder's Proposed Product Substitution Voluntary Alternates Form will be evaluated.

Attach with herewith or submit on day of bid a general description of the proposed option being offered.

Provide detailed information promptly upon request.

END 00 4010

SAMPLE OWNER - CONTRACTOR AGREEMENT
Example of format to be employed upon award

Between:

The Owner: And the General Contractor:

Macomb CUSD No. 185
323 W. Washington St.
Macomb, IL 61455

For the Project:

WASHINGTON STREET GYM HVAC IMPROVEMENTS
MACOMB WASHINGTON STREET GYM
FOR MACOMB CUSD NO. 185

The Owner and Contractor agree to enter into a contract in accordance with the terms and conditions of the Documents (Plans & Specifications), A/E Project Number 2547 0220 and the Contractor's Bid Proposal dated **September 1, 2022,** which become the Contract for completion of the project as follows:

Base Bid Substantial Completion: **April 15, 2023**
Bonus penalty if applicable: See Section 00 2413 Scope of Bid for specific conditions of bonus penalty.

Additional Terms & Conditions: (as applicable)

Addenda: #1_____ #2_____ #3_____ #4_____ (list as applicable)

Contract Amount: (to be listed as appropriate)

Base Bid Proposal including $25,000 allowance	$_____
Alternate Bids as awarded to be listed if applicable	$_____
Total Contract Amount	$_____

(Written)_____ Dollars

Date of Agreement:_____

Signatures:

Owner:	**Contractor:**
Macomb CUSD No. 185	_____
_____	_____
Signature	**Signature**
_____	_____
Title	Title

Contractor's Seal
(Corporation Only)

This Agreement must be signed and returned with the Contractor's Performance Labor and Materials Payment Bonds within fifteen (15) days of notice or the Contractor may be considered in default on acceptance of the award.
END 00 4113

1. GENERAL

1.1. GENERAL CONDITIONS

A. The conditions outlined in this and following paragraphs are to supplement and complement the conditions found in the articles of the AIA Document A201, 2007 Edition.

1. Included in these Specifications by reference is AIA Document A201 General Conditions.

B. AIA Document A201, 2007 Edition, can be purchased directly on line from a variety of vendors including the AIA and are available in electronic format as well as printed.

1. AIA A201 2007 version can be reviewed at the Architects office without charge.

C. To the page one of the AIA A201 General conditions Document:

1. Project: Washington Street Gym HVAC Improvements, 323 W. Washington St., Macomb, IL 61455
2. The Owner: Macomb CUSD No. 185, 323 W. Washington St., Macomb, IL 61455.
3. The Architect: Middleton Associates Incorporated, 1702 W. College Ave., Suite E, Normal, IL 61761 The Engineer Klingner and Associates PLC Quincy IL.

1.2. SIGNING OF DOCUMENTS AND INSTRUMENTS OF THE CONTRACT

A. All documents shall be signed by persons fully and duly authorized to so sign. Any documents signed by a person other than person prescribed by the Contractor's legal organization shall enclose with his signature the evidence of "Power of Attorney."

2. SUPPLEMENTARY GENERAL CONDITIONS

2.1. SUPPLEMENTS TO AIA DOCUMENT A201 (2007 EDITION) THE GENERAL CONDITIONS OF THE CONTRACT.

A. The following sections represent modifications or additions to the AIA A201 -2007 Document.

B. TO ARTICLE 2/OWNER

1. Add Subparagraph 2.2.2.1 Easements off site required by the Contractor to execute the work, such as space for storage, access, scaffolding, lane enclosure, etc., shall be arranged for by the Contractor and included in the contract amount.

C. TO ARTICLE 3 CONTRACTOR

1. To Subparagraph 3.3.1, delete the last two (2) sentences listed under 3.3.1 in their entirety.
2. To Subparagraph 3.3.1 insert: If the Contractor determines that such means, methods, techniques, sequences or proceedings may not be safe, or may not be appropriate to the equipment and task as becomes apparent, then said Contractor shall have included in his proposal amount allowance to complete this work per a revised plan for which he can assume responsibility and shall notify the Owner and Architect before proceeding. In no case do the Owner and Architect take responsibility for directing Contractor Operations.
3. To Subparagraph 3.12

    a. Add 3.12.6.1 Submittals unmarked will not be reviewed at the Architect's option. Said unmarked submittals may be returned to the Contractor for re-submittal and the time loss shall not extend the time of completion of the project.
    b. Add 3.12.6.2 Submittals reviewed by the A/E and returned or held as a record copy presume the Contractor responsibilities in paragraph 3.12.6 have been included whether noted or not.

D. TO ARTICLE 5 SUBCONTRACTORS

1. To Subparagraph 5.2

    a. Add 5.2.5 The assignment of work or a portion of the work by the Contractor to Subcontractor(s) is the election of the Contractor and in no way changes or reduces the Contractor's obligations under the Contract to properly complete the work and/or provide clear title to the work, including the work by said Subcontractor(s).

E. TO ARTICLE 7 CHANGES IN THE WORK

1. To Subparagraph 7.1.2

    a. Add 7.1.2.1 The Contractor and/or his Subcontractor shall not proceed with any work, directive or change for which he intends to claim extra cost without providing written notice to the Architect.
    b. Add 7.1.2.2 The Architect and Owner shall provide response to claims for additional cost within a reasonable time period upon receipt of notice or quote.
    c. Add 7.1.2.3 Work for which an agreement cannot be reached prior to implementation can proceed as time and material work with all parties to agree on what is additional work over that which should have been included to complete the work as originally intended.

2. To Subparagraph 7.2.2

a. Add 7.2.2.1 Change Order quotes shall be based on an approved quote or estimate which shall be based on labor and material cost, actual or estimated as prior agreed upon, and:

b. Add 7.2.2.2 Overhead and profit may be charged proportional to this category of work on the Contractor's CSV or not to exceed the greater of:

1) Eighteen percent (18%) for the Contractor's own work forces
2) Ten percent (10%) Subcontractor plus ten percent (10%) Contractor, for twenty percent (20%) total for work completed under a Subcontractor arrangement.
3) These allowances shall include all off site and indirect costs, including insurance, project management, bonds and profit.

F. TO ARTICLE 9 PAYMENT AND COMPLETION

1. To Subparagraph 9.6.1

a. Add 9.6.1.1 Wherein the Owner is governed by a public Board, payment requests must be received by the A/E 5 days prior to the established time for entering into agenda prior to the next regular Board Meeting. Payments will be made within twenty-five (25) days following Board approval. Failure to make agenda dates will result in a minimum one (1) month delay in payment.

G. TO ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

1. To Subparagraph 10.2.1

a. Add 10.2.1.4 The Contractor shall be responsible to provide and maintain on site MSDS Sheets for all required materials to be brought on site.

1) These sheets shall be readily available upon request to the owner on remodeling renovation projects which are Owner occupied.
2) Comply with VOC regulations.
3) Comply with IEPA regulations.

2. To Subparagraph 10.2.3

a. Add 10.2.3.1 Provide for the general safety of public and Owners employees, such safety provision shall be adjusted as appropriate to the age and volume of public anticipated in the project vicinity.

b. Add 10.2.3.1 Provide for traffic safety as appropriate to the operations; cooperate with the governing authorities on road activities, lane closures, excavations, surface cleaning etc.

H. TO ARTICLE 11 INSURANCE & BONDS

1. To Subparagraph 11.1.2

a. Add 11.1.2.1 Minimum Limits of Liability for preceding coverage are:

1) Workers Compensation - Statutory Limit
2) Applicable Federal *(such as Longshoreman's)* Statutory limits.
3) Liability Insurance may be written as Comprehensive General Liability policy form or Commercial General Liability policy form with the following coverages:

a) Bodily Injury - $1,000,000 each occurrence, $2,000,000 aggregate
b) Property Damage - $1,000,000 each occurrence, $5,000,000 aggregate.
c) Property Damage – Broad Form - $1,000,000 each occurrence, $2,000,000 aggregate.
d) Personal injury (*with employment clause deleted*) $1,000,000 aggregate.
e) Products and completed operations $1,000,000 to be maintained one year following final completion.
f) Business Automobile Liability, (*including owned and non-owned and hired vehicles*)
g) Bodily Injury and Property damage $1,000,000 each person, $1,000,000 each occurrence.

4) Umbrella Insurance may be employed to supplement primary insurance limits to meet required limits.
5) Contractor is responsible for any self insured limits not to exceed $10,000 for any self insured hazards each occurrence
6) In the event that a claim is filed or a settlement reached whether related to this project or not which compromises the aggregate limits of liability then the Owner and Architect shall be notified and arrangements shall be made to provide additional insurance as needed to keep aggregate limits in force for the remainder of the Contract.

2. To Subparagraph 11.1.4

   a. Add 11.1.4.1 The Owner, Architect, and Consulting Engineers including their employees and representatives shall be included as Additional Insureds or Named Insureds on the insurance and shall be shown as such on the Certificate.

3. To Article 11

   a. Add 11.1.5 Contractor's insurance shall be maintained in force through basic warranty and guarantee periods, not less than one (1) year following Final Completion.

4. To 11.3. Property Insurance

   a. Add 11.3.1.1 The Owner's property and vandalism insurance has $1,000 deductible. The Contractor shall insure and thus pay the costs not covered by the Owner's deductibles.
   b. Add 11.3.1.2 The Owner's Builder's Risk will cover only normally included Owner risks, on site, Owner's interest only, excluding tools and property of the Contractor and improperly stored or unsecured materials or loss/damage resulting from contractors operations.

5. To Paragraph 11.4.1 add the following Subparagraphs:

   a. Add 11.4.1.1The Contractor shall furnish Performance and Labor and Material Payment Bonds covering the faithful performance by the Contractor of the work specified in accordance with the plans and specifications and according to the time and terms and Conditions of the Contract, and also that the Contractor shall properly pay all debts incurred in the prosecution of the work, including those for labor and materials furnished and including labor obligations as interpreted by the Illinois Department of Labor and/or the courts.
   b. Add 11.4.1.2 The cost of each bond shall be included in the Contract Sum plus any changes to the Contract Sum. The Contractor shall include in all bonds provisions as will guarantee faithful performance of the prevailing wage provisions of the Contract if applicable.
   c. Add 11.4.1.3 Bonds shall be written by surety, approved by Owner, with a minimum rating of B or better, Financial Class V, or higher, in A.M. Best's Insurance Guide, current edition. The company must also be licensed in the State of Illinois.
   d. Add 11.4.1.4 The Contractor shall require the attorney-in-fact who executes the bonds on behalf of the surety to affix thereto a certified and current copy of power-of-attorney.

e. Add 11.4.1.5 The Contractor shall deliver the required bonds to the Owner not later than fifteen (15) days following the date the agreement is executed.

I. TO ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

1. To Subparagraph 12.2.2.1 After Substantial Completion:

a. Add 12.2.2.1.1 Latent Defects, for a period of 10 years after Substantial Completion, upon demand by the Owner, the Contractor shall promptly repair or replace, including associated work repairs and cleanup necessary, defective or non-conforming work resulting from or constituting latent defects, fraud, fraudulent concealment or gross negligence.

b. Add 12.2.2.1.2 Seasonal equipment such as temperature controls and building systems subject to seasonal loads such as heating equipment and air conditioning, shall be warranted to perform as intended for two years. Exception would be equipment damaged by incorrect operation or maintenance procedures, specifically covered in training, but improperly implemented by the Owner.

c. Add 12.2.2.1.3 Prompt Repair. Upon notice from the Owner or Architect of defects or nonconforming work, the Contractor shall promptly visit the site in the company of the Owner's representative to determine the extent of all defects or nonconforming work. The Contractor shall provide all labor, material and equipment to promptly repair or replace the defective or nonconforming work. The repair shall include all adjacent work not necessarily provided by the Contractor, but damaged as a result of correcting or remedying such defects or non-conforming work. If the Contractor does not promptly pursue correction, the Owner may repair or replace such work and charge the cost to the Contractor. Work which is repaired or replaced by the Contractor shall be inspected and shall be warranted by the Contractor in accordance with this Article.

d. Add 12.2.2.1.4 The warranties set forth herein are in addition to all warranties or guarantees expressed or implied by operation of law, statute or ordinance.

2. To Subparagraph 12.2.2.3, Delete the word ‘not’. Clarification; all materials and equipment are expected to perform satisfactorily for one year, items or equipment needing periodic attention during the first year of use, shall continue to be serviced by the Contractor until such time that the material, item or equipment is deemed to be doing its intended purpose without repeated service.

3. To Subparagraph 12.2.5

a. Add 12.2.5.1 Extended Warranties and Commercial Warranties. The Contractor shall deliver all commercial and extended warranties received from manufacturers to the

A/E prior to Final Payment. Extended warranties and guarantees will be as described under the various trade work sections of these documents, and may be the responsibility of third parties to the contract such as dealers or manufacturer's from whom such extended coverage is specified or as advertised such as a commercial limited warranty of performance or service. Such extended warranties may or may not include labor unless specified, or in the case of commercially advertised warranties as offered by the party selling the product or equipment.

b. 12.2.5.2 Prompt Repair. Upon notice from the Owner or Architect of such defects or nonconforming work, the Contractor shall promptly visit the site in the company of the Owner's representative to determine the extent of all defects or nonconforming work. The Contractor shall provide all labor, material and equipment to promptly repair or replace the defective or nonconforming work. The repair shall include all adjacent work not necessarily provided by the Contractor, but damaged as a result of such defects or non-conforming work or as a result of remedying them. If the Contractor does not promptly repair or replace defective or non-conforming work, the Owner may repair or replace such work and charge the cost thereof to the Contractor. Work which is repaired or replaced by the Contractor shall be inspected and shall be warranted by the Contractor in accordance with this Article. The warranties set forth herein are in addition to all warranties or guarantees expressed or implied by operation of law, statute or ordinance.

J. TO ARTICLE 13 MISCELLANEOUS PROVISIONS

1. To Subparagraph 13.1

a. Add 13.1.1 Location of the project is Illinois.

b. Add 13.1.2 The Contractor shall, to the best of his knowledge and capability, perform all work encompassed by the documents, in compliance with the Environmental Barriers Act (Ill. Rev. Stat. 1985, ch. 111-1/2, pars. 3711 et seq. as amended), the Illinois Accessibility Code, 71 Illinois Administrative Code 400; The Uniform Federal Accessibilities Standards (UFAS); Section 504 of the Rehabilitation Act of 1973, and the Americans with Disabilities Act of 1990 (effective January 26, 1992) known as ADA requirements. This obligation shall apply to the contractual work described as the project and the conduct of work processes initiated to accomplish the work.

c. Add 13.1.3 All parties to this Contract are subject to the rules and regulations of the Illinois Department of Human Rights and the statutory requirements thereof, including the requirement that every party to a public contract shall have adopted written sexual harassment policies (PA 87-1257).

d. Add 13.1.4 It shall be mandatory that the Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, national origin or ancestry, age, marital status, physical or mental disabilities.

e. Add 13.1.5 Illinois Department of Labor requirements. It shall be mandatory upon the Contractor to whom the Contract is awarded and upon any Subcontractors thereof to be in compliance with applicable wage and reporting regulations. This project is a Prevailing Wage Public Works contract.

2. To Subparagraph 13.3.

a. Add 13.3.1 Notice served by facsimile (fax) to facsimile number used during bidding and construction shall be official written notice.

b. Add 13.3.2 Notice served by electronic means (email) to the electronic address used during bidding and construction shall be official written notice.

c. Add 13.3.3 The Bidder shall notify the Architect and/or the Owner at any time of changes in the facsimile or electronic contact addresses that will reach the contractor. Failure to so notify is the Contractors responsibility.

K. TO ARTICLE 15 CLAIMS AND DISPUTES

1. To Subparagraph 15.3.1 Delete the word ‘SHALL’ and Insert the word ‘MAY’.

a. Add 15.3.1.1 Mediation may be employed to resolve disputes if agreed to by both parties to the Contract.

2. To Subparagraph 15.4.1 Delete the word Shall and insert the word ‘MAY’.

a. Add15.4.1.1 Arbitration may be employed to resolve disputes if agreed to by both parties to the Contract.

End 00 7000

1. GENERAL

1.1. REQUIREMENTS INCLUDE

A. Work covered by Contract Documents

1. The Contract includes all phases of the construction work pursuant to the Washington Street Gym HVAC Improvements as set forth in these Specifications and the accompanying Drawings.
2. All work, single Contract.

a. Includes but not limited to:

1) Demolition associated with replacement and renovation work
2) Remove and rand replace transformers

a) Coordinate with Ameren.
b) Coordinate with the owner.
c) Coordinate with new mounting conditions, including setting pads/vaults
d) New raceways, rough in and wiring as need to complete the work which will raise or relocate each transformer

3) New ground mo0uont rooftop units,
a) Support pads
b) Fencing
c) Exterior weather sealed insulated duct work
d) Wall repairs, flashings and weather tight repairs to new ducts.
e) New duct sock interior duct work.
4) Repair all impacted surfaces and surrounds, weather tight and attractive result.

b. New work and equipment as specified in the Documents

B. PRODUCTS FURNISHED BY OTHERS: All products, components, spaces, and equipment furnished by the Owner are currently in place and are to be relocated, disconnected and reconnected as set forth in these Documents (Specifications and Drawings) and/or required to accomplish these Documents. All added components shall be new and furnished by the Contractor.

C. Contractor's Incidental Duties

1. Designate specific delivery date for each product in approved construction schedule.
2. Promptly inspect delivered products, report damaged or defective

items.

3. Handle at site, including unloading, uncrating, and storage.
4. Protect from exposure to elements, from damage.
5. Repair or replace items damaged as result of Contractor's operations.
6. Install, connect and finish products in assembly function ready including incidental related work.

1.2. WORK SEQUENCE

A. The Owner will occupy the adjacent school facilities at varied occupation levels (full occupation during school year minimal occupation summer) during construction.

B. Coordinate the work schedule with the Owner and building administrator.

C. Electrical transformer replacement schedule minimum possible down time on District office operations

1.3. SCHEDULE

A. Project Schedule

1. Specification 00 3000

1.4. CONTRACTOR USE OF PREMISES

A. Confine operations at site to areas permitted by:

1. Law
2. Contract
3. The Owner's Representative, per 1.3.B. above.

B. Do not unreasonably encumber site with materials or equipment. Do not block the Owner's pedestrian traffic patterns except as prior arranged with the Owner's approval.

C. Do not load structure, or components thereof, with weight that will endanger or damage structure.

D. Assume full responsibility for protection and safekeeping of products stored on premises.

E. Move and relocate as necessary all stored products or equipment that interferes with operations of the Owner.

F. Obtain and pay for use of additional off site storage or work area needed for operations.

G. Limited use of site for work and storage

1. Use public access ONLY, now in service. Parking ONLY as prearranged with the Owner.
2. All vehicular on site activity shall have been prearranged and approved by the Owner.

H. Cooperate with the Owner's use of the premises and other Contractors providing work on site under separate Contracts with the Owner.

1.5. CONTINUOUS OCCUPANCY BY OWNER

A. Owner will occupy areas for purposes of conducting educational athletic and physical education and general maintenance during construction.

B. Contractors shall provide

1. Access by Owner's personnel and pupils when applicable.
2. Operation of Mechanical and Electrical systems with a minimum of down time.
3. Operation of exhaust systems with a minimum of down time.
4. Adequate security of the premises in which work is in progress.

C. Upon (after) the work being completed and accepted by Owner, the Owner shall provide:

1. Custodial services
2. Security
3. General custodial maintenance

1.6. ASBESTOS

A. ACM inspection reports are available at the site. The contractor shall perform his own examination of the buildings of concern on the project prior to bidding and be responsible for the determination of the existence or nonexistence of suspect asbestos in a state that is likely to be interrupted or become hazardous to the health of the Contractor, his employees, his subcontractors and their employees.

B. **No known ACM issues impact this project**

C. **If suspect materials are encountered notify the A/E. Owners ACM representative/consultant will be contacted for direction**

D. The Contractor may deem it advisable to contact the Office of Superintendent of Schools and request access to the Asbestos Management Survey applicable to the building pursuant to Section 855.30 (including updated amendments thereto) of AN ACT KNOWN AS THE ASBESTOS ABATEMENT ACT: P.A. 83-1325, approved and eff. Sept. 5, 1984, amended by P.A. 84-0951, approved and eff. Sept. 20, 1985, and amended by P.A. 84-1096, approved eff. Dec. 9, 1985, amended by P.A.

84-1245, approved and eff. July 29, 1986, amended by P.A. 84-1346, and approved and eff. Sept. 10, 1986, inclusive of such amendments and regulations applicable since 1986.

1. Upon determination prior to bidding, or after bidding discovery by the Contractor that an asbestos hazardous condition does exist in the path of execution of the work of his Contract, he shall so notify the Owner IN WRITING.
2. Pursuant to Item 1.6.B.1 above, the Owner (Lincoln Elementary School District No. 27, Lincoln, IL) may implement the following action:

    a. Eliminating that portion of the work by revision and change order to these documents.
    b. Institute removal or acceptance encapsulation.

3. Wherein concealed asbestos is discovered, the Contractor shall notify the Owner of the existence of said apparent asbestos which may require analysis for hazardous determination. This notification shall be IN WRITING at no cost to the Owner. Should analysis indicate that hazardous substance does prevail the procedure shall be set forth under Item 1.6.B.2. above.

    a. NOTE: DELAY IN THE CONTRACTOR'S WORK DUE TO SUCH CONCEALED DISCOVERY AND/OR OWNER RESPONSE THERETO SHALL NOT BE GROUNDS FOR CLAIM FOR EXTRA EXPENSE BY THE CONTRACTOR CHARGEABLE TO THE OWNER AS AN EXTRA TO THE CONTRACT AMOUNT.

1.7. COORDINATION AND COOPERATION

A. It is the intent and purpose of the Owner to cooperate with the Contractor to the extent feasible under existing applicable laws and regulations and the Owner and the Contractor alike shall not construe this portion of the documents, that is, Section Paragraph 1.6.A, and B to the disadvantage of the other.

B. Should the bidding Contractor not understand the foregoing, he shall notify the Architect/Engineer for clarification prior to bidding in accordance with Section 00040, Paragraph 1.3, 1.4, and 1.15.

C. This Contractor shall cooperate with other Contractors and their Subcontractors working on site duly employed by the Owner to perform service related and unrelated to work outlined by these Documents.

D. The Owner has the right to employ other contractors or his own forces to be working on site in concurrence with this Contractor’s work. Coordinate and cooperate to the extent reasonable under the contract so all parties can collectively accomplish the work scheduled.

1.8. FITTING AND FINISHING THE WORK

A. Contractor shall verify all field conditions, dimensions, elevations that relate to the work and properly accommodate these in the work as appropriate to the intended result within the Contract amount.

1. In place construction, obstacles and site conditions and elements which can be seen and reasonably inferred.
2. New construction, obstacles and conditions that can be seen or are to occur in the completion of the work.
3. Allow to fit structural elements and all equipment as occur or will occur during the implementation of the Contract.
4. Make adjustments as needed to fit and properly complete the work. This includes coordination of work by all trades.

B. Contractor and his Subcontractors shall coordinate, accommodate, adjust and fit as appropriate all work to achieve the intended finished intent to normal commercial industry standards.

1. Provide finishing elements, trim, sealants, scribes, receivers and accessories necessary and normal to the installations proposed and as recommended by manufacturers for proper use of products.
2. All construction (all trades) to be weather and infiltration tight. Include appropriate weather seals, infiltration barriers, sealants, non-corrosive flashings and sealants to properly complete the intent of the project.
3. Provide all necessary work to complete all installations, equipment and parts of the work to be complete and properly operable, under control for motorized equipment, in a finished appearance and condition, unless specifically noted otherwise.

    a. Conceal piping and conduit to the extent possible
    b. Run piping and conduit and supports parallel and/or perpendicular to main structural elements when possible.

    c. Avoid creating trip hazards or low headroom hazards when possible
    d. Always allow for service access.

4. Always comply with the Illinois Energy Code

    a. Infiltration tight
    b. Watertight
    c. Insulation and continuous insulation, types and assembly U or R values as well as component ratings.
    d. Air barriers continuous to the extent possible at assembly junctures, windows to walls, walls to roof assembly, walls floor to floor.

END 01 1000

1. GENERAL

1.1. SPECIFIED PRODUCTS

A. All bids shall be based on providing products exactly as specified or equal as prior approved.

B. Products specified only by reference or performance standards, shall be met or exceeded by the standards of any manufacturer's material and subject to the Architect/Engineer's approval.

C. Products specified by naming several products or manufacturers shall be selected from any product and manufacturer named.

1.2. SUBSTITUTIONS, BIDDER/CONTRACTOR OPTIONS

A. PRIOR TO BID OPENING - The Architect/Engineer will consider requests to amend the bidding documents to add products not specified, provided such requests are received in adequate time prior to bid opening date.

1. Requests received after ten (10) days before bid due date will not be considered.
2. If a request is approved, the Architect/Engineer will endeavor to issue an appropriate addendum not less than seven (7) calendar days prior to bid opening date.
3. Ten (10) days is based on the start bid date, and will not be extended by bid extension unless same is extended more than ten (10) days.

B. WITH BID - Substitutions will not be considered with the bids.

C. AFTER AWARD OF CONTRACT - No substitutions will be considered after Notice of Award, except under one or more of the following conditions:

1. Substitution is required for compliance with final interpretations of code requirements or insurance regulations.
2. Unavailability of specified products, through no fault of the Contractor.
3. Subsequent information discloses inability of specified product to perform properly or to fit in designated space.
4. Manufacturer/fabricator refusal to certify or guarantee performance of specified product as required. This does not alter the requirement.
5. When a substitution would be substantially to the Owner's best interest.

1.3. SUBSTITUTION REQUIREMENTS

A. Submit four (4) copies of each request for substitution. Include in each request for substitution:

1. Complete data substantiating compliance of proposed substitution with Contract Documents.
2. For products:

    a. Product identification, including Manufacturer's name and address.
    b. Manufacturer's literature.

        1) Product description.
        2) Performance and test data.
        3) Reference standards.

    c. Samples, if applicable.
    d. Name and address of similar projects on which product was used and date of installation.

3. For construction methods substitution:

    a. Detailed description of proposed methods.

4. Itemized comparison of proposed substitution with product or method specified, including accurate and true cost data on proposed substitution in comparison with product or methods specified.
5. Data relating to changes in construction schedule.
6. Identify:

    a. List other contracts affected, if applicable.
    b. List changes or coordination required.

B. In making requests for substitution, bidder/contractor represents:

1. He has personally investigated proposed product or method and determined that it is equal or superior in all respects to that specified.
2. He will provide the same guarantee for substitutions as for product or method specified.
3. He will coordinate installation of accepted substitutions into work, making all such changes as may be required for work to be complete in all respects.
4. He will provide complete cost data including all related costs under his contract (and other Prime Contract's, as applicable) whose work may also be affected by the substitution in product or method.
5. He will assume full responsibility for all additional costs and expenses to the Owner, Architect/Engineer (and other contractors employed on the same project, as applicable).
6. The Contractor agrees that it is the Contractor's sole responsibility to stand any costs that may be attributable to an allowed substitution that may surface as construction proceeds toward finalization.

C. Substitution will not be considered if:

1. It is indicated or implied on shop drawings or product data submittals without formal request submitted in accordance with Paragraph 1.4 above.
2. Acceptance will require substantial revision of Contract Documents.

END 01 2500

1. GENERAL

1.1. MANAGEMENT OF THE CONTRACT

A. The contractor shall provide necessary project support to manage necessary support documentation in an accurate and timely fashion.

1. Following award, fifteen (15) calendar days, submit two (2) copies:

   a. Signed contracts
   b. Insurance
   c. Bonds, Labor and Material payment and Performance or approved Owner protective bond.
   d. Subcontractor/supplier List – provide promptly prior to signing the of contract
   e. Contractor Schedule of Values, labor and materials and by trade and task breakdown.

2. Pre-Construction meeting:

   a. Provide proposed schedules
   b. Project access for remodel/renovation projects
   c. Project security plans, fences, storage facilities, public access control.
   d. Proposed schedule
   e. Contact information
   f. Identify Project management team, Superintendent of the work,

3. Prior to start of the work on site:

   a. NOI permit from IEPA as applicable on projects excavating over 1 acre or more.
   b. Background check information as applicable to this project.
   c. Permits
   d. Have in place the safety plan and assigned safety person on the site. Safety is the responsibility of the contractor, and is not monitored or directed by the Owner or the A/E except in apparent emergency situations where the Owner or the A/E might assist in determination of safety accommodations as identified by the contractor.
   e. Have in place the fences and barricades to control public or non-contractor access to the site.

1.2. SUPERINTENDENT OF WORK

A. The Contract shall designate a person who shall be General Superintendent of on site construction work encompassed by the Contract Documents.

1. Said designated superintendent shall have prior served as project superintendent of construction of similar nature and size. Qualifications shall be subject to the Owner’s and Architect's review.
2. Superintendent shall remain superintendent for the duration of the project unless said person shall become disabled, no longer employed by the Contractor. The Contractor shall provide notice to the Architect and the Architect and Owner shall approve the personnel change.
3. Owner can request superintendent replacement for cause at any time.

1.3. AWARD AND LETTER OF INTENT

A. The Owner will make an award based on the selection of the lowest cost responsible bidder that has demonstrated past experience and evidence of adequate resources to accomplish the work. After the award, and the issuance of a Letter of Intent, the contract timeline is as follows:

1. Return signed agreement seven (7) days
2. Sub Contractor, Supplier, or any entity to be assigned a part of the work, provide list, addresses and contact information. Seven (7) days. Provide references upon request. Seven (7) days:
3. Labor and Materials, Payment, and Performance bonds, 15 days
4. Insurance, 15 days
5. Master Cost Breakdown (CSV), 15 days
6. Proposed Schedule and time line, 15 days

B. Failure or refusal to provide the preceding Contract information in a timely manner may be cause for cancellation of the award or termination of the agreement if signed and the Owner will be entitled to compensation under the terms of the bid security for failure to execute contract terms in good faith.

1.4. MATERIALS SPECIFIED AND QUALITY OF WORK

A. Materials shall be as specified or approved equal.

B. "Approved equal" and "or equal" shall mean that the Contractor shall be required to receive the Owner's approval (via the Architect) on any substitute materials seven (7) days prior to the bid due date.

C. Requests for substitution approval shall be submitted to the Architect/Engineer.

1. Prior to considering substitutions, the Owner and/or the Architect/Engineer may require submission of samples, descriptive, technical and catalog data and lab reports of tests for verification of equivalency.
2. Said submittals shall be presented to Architect/ Engineer.

1.5. PROGRESS PAYMENTS

A. All payments by the Board of Education require Board approval.

1. Payment requests must be submitted prior to the first Monday of the month for consideration and entry into the agenda.
2. Untimely submission of payment request will result in a one (1) month delay for consideration.
3. The Contractor will be notified of the regular Board meeting schedule upon request.
4. Payment will be made within twenty (20) days following board approval, or a notice of board concerns will be provided.

B. In accordance with the terms of the Contract periodic partial progress payments may be made monthly to the Contractor for: 90% of the value of the labor, materials, and/or equipment incorporated in the construction.

1. Payment will be for completed progress materials only.
2. Materials properly stored and protected on site may be billed
3. Payment for Materials off site may be considered if properly warehoused, dedicated to this project and insured. Submit all information and same will be reviewed and may be approved or denied for payment.
4. Progress pay requests shall indicate amounts completed of all items listed from the master breakdown.
5. 10% of each request will be retained by Owner until work has been satisfactorily completed.
6. Submit lien waivers for preceding payments made.
7. Submit lien waivers from subcontractors and suppliers.
8. Submit notarized Contractor's affidavits with each pay request showing that total owed on Contract by Owner (after subject request has been paid to Contractor) is more than the amount to become due the Contractor for material, subcontractors and labor.

C. All the applications for payment shall be made in three (3) copies with all copies bearing live seals and signatures, notarized and complete and accurately filled in.

1. Applications for payment shall be submitted to Architect/Engineer on AIA G-702A Forms or other standard formats containing similar information.

D. Public Projects only: Attach one (1) copy of Contractor’s Certified Prevailing Payroll with Pay Request in accord with Dept. of Labor requirements. Include Payroll for the major Subcontractors and upon request any minor or intermittent on-site Subcontractor.

1. Submit beginning with the first application for payment for all workers employed on site
2. Submit for each successive month with each pay request.

1.6. FINAL PAYMENT: The final application for payment shall not be made until all work and deficiency (punch list) items have been satisfactorily completed and approved by the Architect/Engineer for documents compliance.

1.7. EMPLOYEE-STUDENT RELATIONSHIPS

A. Except in an emergency situation involving safety, there is to be no intermingling of the Contractors' employees and the school faculty, staff and students violating this requirement shall be removed from employment at this site. Contractor employees experiencing problems with students or faculty shall report same to their project superintendent, who shall promptly report the problem to an authorized representative of the Owner and the Architect/Engineer.

1. Avoid profanity and inappropriate subject matter in conversation as students and staff may be within audible range and walls or ceiling spaces may allow sound transmission.
2. Verbal or physical action interpreted as sexual or sexually suggestive in nature or as sexual harassment will be grounds for removal of the employee from the site. Further legal action remains the option of the persons affected.
3. In all aspects of this provision, the Contractor’s employees as adults have the greater responsibility and should not respond to inappropriate student behavior.

B. Authorized agents of the Owner include the District Superintendent, District Building and Grounds Supervisor, the District Financial Services Director and the Architect/Engineer. The School Principal is authorized to discuss concerns regarding operations on site, but is not authorized to order changes in the work.

End 01 3000

1. GENERAL

1.1. DESCRIPTION

A. Prior to commencing the work, the Contractor shall provide submittals on all materials and equipment proposed for the work.

1.2. SHOP DRAWINGS, SUBMITTALS, AND SUBMITTAL BROCHURES

A. Submit four (4) copies paper, or one pdf emailed minimum unless notes otherwise in a particular section.

1. Electronic submittals by pdf are preferred directly emailed in not through a posting service.
   a. Paper copies will still be required for the O&M manual along with pdf.
2. Electronic submittals shall be tailored to the project, do not submit a 25 page catalog that 2 pages apply to this contract.
3. Clearly delineate applicable products and selections.

B. Architect and/or Owner will retain two (2) copies.

C. Contractor will receive remaining copies for his use.

1. Maintain records for submittal of Operations and Maintenance mauls at the conclusion of the work.

   a. Two (2) copies, Or one copy and an electronic copy.

D. Shop drawings and material schedules shall be accompanied by catalog cuts or literature providing all data, description, function, and capacity of item or component submitted.

E. Catalogs and fliers with multiple component descriptions shall be clearly and precisely marked as to submittal item. The Architect/Engineer's office will provide no sorting to assure the submittals match with documents requirements.

1.3. SAMPLES

A. When samples are requested submit two (2), unless arranged otherwise.

B. All samples will be retained unless otherwise noted in the documents or requested by the vendor. Samples for return may be held until the material is installed on site.

1.4. PROJECT RECORD INFORMATION

A. The Contractor shall, within seven (7) days of Notice of Award, submit to the Architect the following:

1. Name of person under Contractor employment at the job site in charge of the work and safety.
2. Provide a contact list including emergency contact information for all relative parties to the work, including the superintendent, the project manager, subcontractors, and major vendors.

1.5. PROJECT RECORD DOCUMENTS

1. Operating and Maintenance Manuals.

   a. Submit three (3) bound, indexed copies minimum.
   b. These manuals shall include all Shop Drawings and all Submittals, all Equipment Brochures, Operating Manuals, Operating Instructions, names, addresses, and telephone numbers for guarantee work, all bound into a good quality binder or loose-leaf notebook, clearly labeled.
   c. THE SHOP DRAWINGS RETAINED BY THE OWNER AND ARCHITECT ARE NOT AVAILABLE FOR PREPARING THESE MANUALS. If additional copies are required for this, the Contractor shall make allowance and copy additional sets.
   d. Include warranty information and warranty contact information.

2. Record drawings: Maintain as work proceeds record drawings marked to show any variances in installations, particularly underground and concealed services.

1.6. AS-BUILT DRAWINGS

A. The Contractor shall provide the Architect/Engineer's Office with one marked set of drawings showing changes from the original drawings. Marked As-Built Drawings shall be submitted upon progress having Substantial Completion progress.

   1. Preferably markings should be in red, clearly legible and easily understood.
   2. Clearly and boldly label the set As Built or Record Drawings.

1.7. IDENTIFICATION OF SUBMITTALS

A. The Contractor shall clearly mark each submittal of the Shop Drawings, Catalog Cuts, Pamphlet, or Specification Sheet for identification and record, for example:

   a. DATE: As submitted
   b. BUILDING: Project Name
   c. LOCATION: City
   d. TYPE OF EQUIPMENT: (Example – AHU 1)
   e. SUBMITTED BY: Contractor's Name and contact information for questions.

   2. Data shall also indicate model number selected for furnishing and

indicate capacities or conditions or operation.

a. Catalog data of general advertising nature, without specific outline or rating for equipment, will be rejected.
b. Marked product manufacturer's catalogs and engineering data shall accompany the submittal.

1.8. REVIEW OF SUBMITTALS

1. Submittals will be reviewed by the Architect and/or the Owner and will be checked for Contract compliance and the basic fabrication methods.

2. The Contractor must verify all the dimensions, field conditions, field clearances, and rough-in requirements with adaptations as necessary.
3. Submittals are to be reviewed and corrected first by the Contractor. If submittals contain obvious oversights or conditions that make it apparent they have not been checked, they will be returned for re-submittal.
4. Architect/Engineer review of a submittal shall not relieve the Contractor of contract compliance unless any variance is specifically brought to the attention of the Architect and/or Owner IN A LETTER FORM attached to the submittal data and subsequently approved by the Architect/Engineer IN WRITING.
5. An omission on the shop drawings or a review oversight by the Architect/Engineer shall not be construed as the calling of specific attention thereto.
6. It is not the responsibility of the Architect Engineer to request submittals, failure to submit presumes contract compliance is understood.
7. It is not the responsibility of the Architect Engineer to provide rapid review turnaround on a delayed submittal to maintain schedule. The Contractor shall make submittals in a timely manner generally allowing at least ten (10) days for review.

END 01 3300

1. GENERAL

1.1. REQUIREMENTS INCLUDE

A. Contractor:

1. Coordinate work of all crafts including that of subcontractors and his crafts as applicable.
2. Schedule elements of remodeling and renovation work to expedite completion.
3. Schedule noisy or hazardous work to avoid problems with the Owner's day-to-day building functions and general maintenance operations.
4. In addition to required incidental demolition specified in various sections, and that shown on Drawings, cut, move or remove existing construction to provide access or to allow remodeling and new work to proceed. Include:

    a. Removal of temporarily or permanent Electrical and Plumbing devices, circuits and piping plus the reinstallation of same as required to continue service.
    b. Removal of unsuitable or extraneous materials and non-functioning components not marked for salvage, such as abandoned furnishings and equipment, and debris such as rotted wood, rusted metals, abandoned electrical and mechanical components, and deteriorated concrete.
    c. Cleaning of surfaces. Remove surface finishes to install new work and finishes.

5. Patch, repair and refinish existing items to remain, to the specified condition for each material, with a neat transition to adjacent new construction.
6. Move room furnishings to allow access to specified floor, wall and ceiling work. Relocate same in place at the completion of specified rehab work.
7. Cooperate with the Owner and schedule ahead pursuant to rehab work at locations involving preparatory work by Owner - see 1.1.B. of this section.

B. Owner:

1. Remove, store and replace books and files to allow Contractor access to floors, walls and ceiling, room by room, on schedule determined by the Contractor.
2. Cooperate with the Contractor pursuant to providing Contractor access to rooms and areas scheduled for rehab - see 1.1.A. 6 & 7 this section.

1.2. RELATED REQUIREMENTS

A. Specified elsewhere:

1. DIVISION 0 - PROCUREMENT REQUIREMENTS
2. DIVISION 1 - ADMINISTRATIVE REQUIREMENTS

1.3. SEQUENCE AND SCHEDULES: Schedule work in sequences within times specified in 01 1000.

1.4. ALTERATIONS, CUTTING AND PROTECTION

A. Assign moving, removal, cutting and patching work to crafts qualified to perform the work in a manner to cause least damage to each type of work, and provide means of restoring surfaces to appearance of new work.

B. Perform cutting and removal work to minimize removals, and in a manner to avoid damage to adjacent work.

1. Cut finish surfaces such as masonry, tile, plaster or metals by methods to terminate surfaces in a straight line at a natural point of division.

C. Perform cutting and patching in accordance with the general and supplementary General Conditions.

D. Protect from damage existing finishes, equipment and adjacent work which is scheduled to remain.

1. Protect existing and new work from weather and temperature extremes.
2. Provide weather protection, waterproofing, heat and humidity control to prevent damage to remaining existing work and to new work.

2. PRODUCTS

2.1. SALVAGED MATERIALS

A. The Contractor shall:

1. Remove all existing reusable components such as hardware, (hinges closers, locks, panic sets, door stops, kick plates and latch sets) and deliver same to the Owner at a location to be determined by the Owner.

2.2. MATERIALS FOR PATCHING, EXTENDING AND MATCHING

A. Ensure that work is complete:

1. Provide same materials or types of construction as that in existing structure, to patch, extend or match existing work.

a. Contract Documents may not define products or standards

of workmanship present in existing construction.

b. Consult the Drawing Details and/or consult the Architect/Engineer.

2. Presence of a product, finish or type of construction requires that patching, extending or matching be performed to make work complete and consistent to identical or better quality standards.

3. EXECUTION

3.1. REMOVE EXISTING CONSTRUCTION

A. Consult the drawings for removals and replacements as set forth.

3.2. PERFORMANCE

A. Patch and extend existing work using skilled craftsmen capable of matching existing quality of workmanship.

B. For patched or extended work, provide quality equal to that specified for new work.

3.3. ADJUSTMENTS

A. Where existing construction and components are removed, patch floors, walls, doors, trim, and ceilings with finish materials to match existing as closely as possible.

3.4. DAMAGED SURFACES RESULTING FROM CONTRACTOR WORK

A. Patch and replace all portions of the existing finished surfaces found to be damaged, lifted, discolored or showing other imperfections, with matching material.

1. Provide adequate support prior to patching the finish.
2. Refinish patched portions of painted or coated surfaces in a manner to produce uniform color and texture over entire surface.
3. When existing surface cannot be matched, refinish entire surface to nearest intersections.

3.5. TRANSITION FROM EXISTING TO NEW WORK

A. When new work abuts or finishes flush with existing work, make a smooth transition. Patched work shall match existing adjacent work in texture and appearance as closely as possible.

1. When finished surfaces are cut in such a way that a smooth transition with new work is not possible, terminate existing surface in a neat manner along a straight line at a natural line of division, and provide trim appropriate to finished surface.
2. Refinished surfaces must be weathertight as appropriate to the exposure

3.6. CLEANING

A. Perform construction cleaning as specified in Section 01 7800.

1. Clean Owner occupied areas, where work prevails, daily.
2. Clean all spillage, overspray and heavy dust collections in Owner's occupied areas immediately.

B. At completion of work of each craft, clean area and make surfaces ready for work of successive crafts.

C. At completion of alterations work in each area, provide final cleaning for occupancy and return space to a condition suitable for use of Owner.

END 01 3516

1. GENERAL

1.1. GENERAL TERMS USED IN THE CONTRACT

A. OWNER: Macomb CUSD No. 185, 323 W. Washington St., Macomb, IL 61455

B. CONTRACTOR: A person, firm or corporation with whom a Contract or Agreement is made by the Owner.

C. GENERAL CONTRACTOR: The General Contractor furnishes all of the work in the documents. Pursuant to these Documents the Designating Contractor, General Contractor and Prime Contractor shall be one and the same.

D. ARCHITECT OR A/E: Middleton Associates, Incorporated, 1702 W. College Ave., Suite E, Normal, IL 61761 - Telephone 309/452-1271, Fax 309/454-8049, e-mail: russ@middletonassociates.net

1. Consulting Engineer: Klingner & Associates P.C., 616 N. 24th St., Quincy, IL 62301. Telephone 217/223-3670, email Steven F. Damm <sdamm@klingner.com>

E. DOCUMENTS: The Drawings, Specifications and Contract as apply to all areas of the work.

F. WORK: All obligations undertaken by the Contractor, pursuant to the Contract Documents.

1. Work includes, but is not limited to, the furnishing of all of the materials, labor, equipment, supplies, plant, tools, scaffolding, transportation, unloading, superintendence, insurance, bonds, taxes and all other services, facilities, required demolition (major and minor as applicable) and expenses necessary for the full performance and completion of requirements of the Contract Documents.
2. Work also means that which is produced, built, or constructed, pursuant to the Contract Documents.
3. Work includes all labor and materials to properly install and make functional.

G. PROVIDE: Furnish and install (including materials, accessories and labor) ready for the Owner's use. Comply with manufacturer's installation requirements as minimum standard, Drawings and Specifications where installation requirements exceed manufacturer's recommendations.

H. EQUAL, APPROVED EQUAL: Alternative products meeting or exceeding the base specification product or process and approved by the Architect/Engineer IN WRITING as suitable for this application. If not

accepted prior to bidding, acceptance is discretionary.

I. SUBSTANTIALLY COMPLETE: When work progress has arrived at the point where the Owner may have full use of the installation for the purpose for which the same was installed, all components installed, equipment operating under control and minimum code compliance achieved, then, the work may be declared substantially complete if so requested by the Contractor and specifically approved by the Owner.

J. PUNCH LIST: Those items, components, installation inclusive of labor and materials (in place) which, in the opinion of the Architect/Engineer or the Owner do not conform to the intent of the Contract Documents and/or adequately satisfy the purpose and intent of the Owner.

K. DESIGNATED WORK: Wherein the documents designate that one contractor shall provide specified material and labor for another trade area contractor, the cost of the work and material shall be included in the bid of the contractor that is designated to provide the material and labor.

L. AND/OR: Wherein employed in the documents shall be either and both, singularly and together, as applicable to the intent of the Project Documents.

M. CONCEALED: Concealed building components, services, and obstacles subject to Change Orders, shall be limited to those components, services, obstacles, etc., not designated or known to exist, not typical to the type of construction observed and not available for inspection without destructive action. Opening of access panels, looking above accessible ceiling systems or inside chase walls is not considered concealed items.

1.2. In general, definitions of words employed in the Contract Documents shall be as defined in "Webster's New World Dictionary" the latest edition. The Architect shall be the interpreter in the case of multiple meanings. Exceptions to this shall include longstanding meanings in the construction industry but have not been so defined in Webster's Dictionary. Determination shall be in accordance with these Specifications.

END 01 4216

1. GENERAL

1.1. WORK INCLUDES

A. Contractor shall provide and maintain specified temporary utilities.

B. Contractor may extend electrical and water services from Owner's existing sources.

1. Tap on and extension of services shall be implemented and paid for by the Contractor requiring utility.

a. Tap on arrangements must be coordinated with the Owner, and shall not compromise the Owners operations or equipment.

2. Return tap on surrounds to original or contracted configuration and circumstances at close of job by the Contractor.
3. Extension shall not compromise Owner’s operations.

C. Contractor shall furnish (included in his Base Bid):

1. The cost of all utilities required by him which:

a. Are in excess of existing available at the building and are necessary for the completion of his work.
b. Exceed the capacity of existing or permanent systems and are necessary for the completion of his work.
c. Required prior to permanent enclosure.

2. Extension cords, extension lights and lamps from approved temporary power centers to his work.
3. Ventilation for his storage spaces containing volatile or hazardous materials.
4. Security for materials and equipment.
5. Heating as needed to protect construction form freezing or frost damage.

D. Furnished by Owner

1. Authorization of existing facilities for temporary use.

a. Electrical power service
b. Water service extended from existing outlets by the Contractor

2. Owner will pay all costs of power and water consumables used for construction purposes for utilities properly extended.

3. The Contractor requiring Owner-furnished services, shall provide and pay for extension or modification of services to perform the work and for restoration of services and Owner equipment at completion of the work.

E. Water Service:

1. For construction purposes:

a. The Contractor shall provide and maintain temporary water service connection throughout construction period.
b. The Contractor shall supply adequate water hoses from hose bibs to the point of his operations.

2. For temporary fire protection and cleaning.
3. Maintain adequate volume of water for all purposes.
4. The Contractor provides drinking water for his own forces.
5. Water source: On or off site.

1.2. COST OF INSTALLATION, OPERATION, MAINTENANCE & CONSUMABLES

A. Installation, operation and maintenance:

1. The Contractor requiring service extensions shall pay all costs of installation, operation, maintenance, restoration and equipment warranty extension of temporary utilities for designated time periods.
2. The Contractor shall not overload the system.

B. Consumables:

1. Contractor pay all costs of consumables for temporary utilities, as designated:

a. Heating Fuel via Temporary Heating Units: Contractor requiring same.
b. Heating
c. Electrical Energy Contractor except as properly extended.
d. Lamps: Contractor requiring same.
e. Water: Owner as properly extended.
f. Toilets and Supplies: Contractor
.
1) One on site toilet adjacent to boiler room may be used as long as it is not damages, made a mess and is left clean at end of the work.

1.3. MONITORING OF TEMPORARY UTILITIES

A. The Contractor extending or providing a temporary utility extension shall be responsible for all damage to his work or to the existing facility caused by a defect in temporary utilities or utility extensions.

1. Enforce compliance with specified codes and standards.
2. Enforce safe practices.
3. Prevent abuse of services and utilities.
4. Prevent damage to finishes.

B. Upon completion of work, or when directed by Architect/Engineer, restore existing systems to original condition.

2. PRODUCTS (Not applicable)

3. EXECUTION

3.1. ALL TEMPORARY UTILITIES AND EXTENSIONS

A. Comply with DIVISION 15 and DIVISION 16 Specifications and Federal and State regulations.

B. Install work in a neat and orderly manner.

C. Be made structurally, mechanically and electrically sound throughout.

D. Be maintained to give safe, continuous service, and to provide safe working conditions.

E. Be modified and extended as work progresses.

3.2. INSTALLATION

A. Electrical:

1. Protect branch circuits or extension wiring on floor or on ground from damage.
2. Provide ground fault outlets
3. Wiring for temporary heating and ventilating equipment:

a. Wire all safety devices specified for operation or equipment.
b. Verify proper operation of all safety devices.

3.3. REMOVAL & REINSTALLATION

A. At the conclusion of the work, completely remove temporary materials and equipment.

B. Repair all damage caused by installation. Restore to original condition or better.

END 01 5000

1. GENERAL

1.1. WORK INCLUDES

A. Completed Deficiency List

B. Final Cleaning

1. Clean all finished areas ready for occupancy, dust, remove debris, mop or vacuum as appropriate, seal and wax if specified. Concrete sealers free of scuffs and scratches
2. Unoccupied areas, above ceilings, tunnels, chases, Mechanical areas, roof, etc., free of debris reasonably cleaned up of construction scraps, tools boxes.
3. Equipment cleaned and ready for occupied use, new filters, and spare filters stored in location directed.
4. Site and exterior cleaned up, no debris, equipment, tools removed.

    a. Sidewalks clean
    b. Earthwork finish graded, seeded if specified
    c. Drainage ways open

C. Project Record Drawings

1. Contact list of Installing Contractor and/or Subcontractors.

D. Maintenance Information

1. Provide operations and Maintenance manual containing all information relative to the future operation and maintenance of the facility:

    a. Warranty contact information
    b. Instruction booklets for all equipment, relative parts sources and care instructions
    c. Contact information and extended warranty information

E. Guarantees, Warranties and Bonds

1. Contact list for warranty claims.

F. Submittal

1. All materials shall be submitted in multiple copies in an orderly and labeled fashion.
2. Generic documents not filled in, dated, and job specific are not acceptable.

1.2. EVIDENCE OF COMPLETION OF THE CONTRACT

A. Equipment and Building

1. All equipment operational as intended, under control, installed per Manufacturer's recommendations.
2. All construction completed, finished and in new condition.
3. All deficiencies addressed to the satisfaction of the A/E and Owner.

a. Return Punch List with each completed item initialed by the Contractor representative who has inspected the corrective work.

1.3. COORDINATE FINAL CODE INSPECTIONS

A. Work with governing authorities for occupancy inspection.

1. Municipality
2. Regional Superintendent of Schools (school project).
3. IDPH for plumbing and any other IDPH permitted work.
4. A/E for called inspection when applicable.
5. Fire Marshall, local / state for:

a. Elevator, if applicable
b. Sprinklers, if applicable.
c. Fire alarm, if applicable.
d. Walk-through
e. Boilers

1.4. WARRANTIES

A. Extended warranties beyond the one (1) year 100% labor and material overall warranty shall be provided showing:

1. Terms and dates
2. Contact information
3. Installing Contractor
4. Exact system / material as applicable.

B. Extended warranties

1. As listed in various Specification Sections.
2. As advertised by Manufacturers.
3. As required for:

a. Hardware – five (5) years
b. Refrigeration equipment – five (5) years.
c. Wet rotor circulator pumps – three (3) years
d. Roofing – twenty (20) years
e. Insulated glass – ten (10) years
f. Carpet – Contractor: two (2) years; Manufacturer: fifteen (15) years

g. HDPE Toilet Compartments – fifteen (15) years HDPE material; five (5) years hardware material
h. Visual Display Surfaces – Manufacturer – five (5) years
i. Lockers – five (5) year minimum (or Manufacturer's advertised if extended)

4. Items requiring chronic repair during the warranty period shall have an extended 12-month warranty until repairs are not needed over a 12-month period.

1.5. PROJECT RECORD DOCUMENTS

A. Submit Project Record Documents to reasonably provide information on:

1. Hidden utilities
2. Products used.
3. Any hidden from view structural or mechanical or electrical variations from plans.
4. Notation of alternates where same impacted the Base Bid Drawings.

B. Provide listing:

1. Contractor / Subcontractor / Vendor list with:

a. Product or service.
b. Contact information.

1.6. FINAL PAY APPLICATION

A. Final Lien Waivers – Major Subcontracts and direct Suppliers.

B. Final Affidavit showing $0.00 due to all vendors.

C. Letter from Bond holder approving closeout payment.

D. Final paperwork on allowances, adds or deductions agreed upon by Change Order.

E. Final acceptance as applicable.

END 01 7800

SECTION 230500

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
6. Grout.
7. HVAC demolition.
8. Equipment installation requirements common to equipment sections.
9. Supports and anchorages.

1.2 SUBMITTALS

A. Welding certificates.

B. Submit product information for all materials used for the various mechanical systems.

1.3 REFERENCES

A. Standards:

1. ASME American Society of Mechanical Engineers.
2. AWWA American Water Works Association.
3. UL Underwriters Laboratories, Inc.
4. MCA Mechanical Contractors Association.
5. IBR Institute of Boiler and Radiators Manufacturers AISE Association of Iron & Steel Engineers.
6. SAE Society of Automotive Engineers.
7. NEMA National Electric Manufacturers Association ASTM American Society for Testing and Materials.
8. ANSI American National Standard Institute.
9. AWS American Welding Society.

1.4 DEFINITIONS

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

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

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

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

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

1.5 QUALITY ASSURANCE

A. All equipment and materials shall be new and of first quality. Manufactured products shall be Manufacturer's standard product with specified options but shall not be field or factory modified unless specified. All materials and equipment shall bear the Manufacturer's nameplate or marking with type, size, catalog numbers and ratings as appropriate.

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

C. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Acceptance (at site): Take delivery of all items delivered to site. Be responsible for inspection of materials and equipment to detect transit damage.

B. Protection (prior to application or installation):

1. Materials shall be stored inside building. Piping may be stored outside.
2. Be responsible for all damage to materials stored on site.

1.7 PROJECT CONDITIONS

A. When existing conditions prohibit the proper installation as shown on the Drawings or as specified herein, the Contractor shall notify the Engineer/Architect, in writing, requesting a solution.

B. Contractor is responsible for the verification of new and existing conditions on the site before that particular phase of installation begins.

1.8 WARRANTY

A. Contractors and manufacturers warranty shall be 1 year after substantial completion.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12.

G. Solvent Cements for Joining Plastic Piping:

1. CPVC Piping: ASTM F 493.
2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.3 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.4 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: Carbon steel. Include two for each sealing element.

D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

B. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

D. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

E. PVC Pipe: ASTM D 1785, Schedule 40.

F. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated Rough brass Polished chrome-plated and rough brass.

2.7 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.8 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.9 TESTING OF PIPING SYSTEMS

A. Piping Systems:

1. Contractor shall subject all piping and equipment to a test of 125 psi for a period of 8 hours and all leaks developed shall be repaired and the test repeated until the system is absolutely tight.
2. Disconnect all traps and devices not rated for operation at test pressures.
3. All instruments and equipment required for testing shall be furnished by the Contractor and tests shall, if so requested, be made in the presence of the Engineer/Architect.

3.10 ADJUST AND CLEAN

A. Protection of Completed Work:

1. When work is completed it shall, when it is subject to damage by ongoing construction, be protected from this damage.
2. As work is being installed, equipment and piping shall be protected from other ongoing construction or from its own construction. Exposed piping ends should not be temporarily covered; hanger shall be supplied in sufficient number to prevent warping or bending of pipe.

END OF SECTION 230500

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes TAB to produce design objectives for the following:

1. Air Systems:

a. Constant-volume air systems.
2. Verifying that automatic control devices are functioning properly.
3. Reporting results of activities and procedures specified in this Section.

1.2 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.

D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

E. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

F. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

G. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

H. TAB: Testing, adjusting, and balancing.

I. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

J. Test: A procedure to determine quantitative performance of systems or equipment.

K. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.3 SUBMITTALS

A. Qualification Data: Within 45 days from Contractor's Notice to Proceed, submit 4 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. TAB plan that includes strategies and step-by-step procedures.

C. Sample Report Forms: Submit two sets of sample TAB report forms.

D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm and **stamped by a Licensed Professional Engineer**

1.4 QUALITY ASSURANCE

A. TAB Firm Qualifications: (TAB firm must meet all of the qualifications listed)
1. Certified by AABC, NEBB, TABB, or balancer must have completed 40 hours (minimum) of TAB training.
2. Work performed under the direct supervision of a Licensed Professional Engineer.
3. Minimum TAB experience of 5 years.

B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard forms from TAB firm's forms approved by Architect.

D. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

E. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.

1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.5 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.6 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 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.

1. Contract Documents are defined in the General and Supplementary Conditions of Contract.
2. Verify that balancing devices are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine Project Record Documents described in Division 01 Section "Project Record Documents."

D. Examine equipment performance data including fan curves.

E. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

F. Examine system and equipment test reports.

G. Examine HVAC system and equipment installations to verify that indicated balancing devices are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

H. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

I. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

K. Examine equipment for installation and for properly operating safety interlocks and controls.

L. Examine automatic temperature system components to verify the following:

1. Dampers, valves, and other controlled devices are operated by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
5. Sensors are located to sense only the intended conditions.
6. Sequence of operation for control modes is according to the Contract Documents.
7. Controller set points are set at indicated values.
8. Interlocked systems are operating.
9. Changeover from heating to cooling mode occurs according to indicated values.

M. 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.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Isolating and balancing valves are open and control valves are operational.
6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 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 Testing and Balancing Heating, Ventilating, and Air Conditioning Systems", NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", or SMACNA's TABB "HVAC Systems - Testing, Adjusting, and Balancing" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

D. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling unit components.

K. Check for proper sealing of air duct system.

3.5 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 the total supply airflow at the unit using a pitot-tube traverse.

   2. Measure fan static pressures to determine actual static pressure as follows:

      a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
      b. Measure static pressure directly at the fan outlet or through the flexible connection.
      c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
      d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

   3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

      a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

   4. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
   5. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with

calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.

6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
7. 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 will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

    a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.7 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

A. Refrigerant Coils: Measure the following data for each coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.9 PROCEDURES FOR TEMPERATURE MEASUREMENTS

A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.10 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Check free travel and proper operation of control devices such as damper and valve operators.

F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.

G. Check the interaction of electrically operated switch transducers.

H. Check the interaction of interlock and lockout systems.

I. Check main control supply-air pressure and observe compressor and dryer operations.

J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.11 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
2. Air Outlets and Inlets: 0 to minus 10 percent.
3. Heating-Water Flow Rate: 0 to minus 10 percent.
4. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.12 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of instruments used for procedures, along with proof of calibration.

C. 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, but do not include Shop Drawings and Product Data.

D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of TAB firm.
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 firm 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, type size, and fittings.
14. Notes to explain why certain final data in the body of reports varies from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outside-, 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.

E. 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 outside, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Balancing stations.
4. Position of balancing devices.

F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data: Include the following:

    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. Sheave dimensions, center-to-center, and amount of adjustments in inches.
    j. Number of belts, make, and size.
    k. Number of filters, type, and size.

2. Motor Data:

    a. 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. Sheave dimensions, center-to-center, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm (measured at unit discharge)
    b. Total airflow rate in cfm (summation of air terminals)
    c. Total system static pressure in inches wg.
    d. Fan rpm.
    e. Discharge static pressure in inches wg .

f. Filter static-pressure differential in inches wg.
g. Preheat coil static-pressure differential in inches wg.
h. Cooling coil static-pressure differential in inches wg.
i. Heating coil static-pressure differential in inches wg.
j. Outside airflow in cfm.
k. Return airflow in cfm.
l. Outside-air damper position.
m. Return-air damper position.
n. Vortex damper position.

G. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outside-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Refrigerant expansion valve and refrigerant types.
i. Refrigerant suction pressure in psig.
j. Refrigerant suction temperature in deg F.

H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.

I. Air-Terminal-Device Reports:

1. Unit Data:

    a. System and air-handling unit identification.
    b. Location and zone.
    c. Test apparatus used.
    d. Area served.
    e. Air-terminal-device make.
    f. Air-terminal-device number from system diagram.
    g. Air-terminal-device type and model number.
    h. Air-terminal-device size.

2. Test Data (Indicated and Actual Values):

    a. Airflow rate in cfm.
    b. Preliminary airflow rate as needed in cfm.
    c. Final airflow rate in cfm.

J. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Unit make and model number.
    d. Compressor make.
    e. Compressor model and serial numbers.
    f. Refrigerant weight in lb.
    g. Low ambient temperature cutoff in deg F.

2. Test Data (Indicated and Actual Values):
    a. Entering-air, dry-bulb temperature in deg F.
    b. Leaving-air, dry-bulb temperature in deg F.
    c. Control settings.
    d. Low-pressure-cutout set point in psig.
    e. High-pressure-cutout set point in psig.
    f. Suction pressure in psig.
    g. Suction temperature in deg F.
    h. Condenser refrigerant pressure in psig.
    i. Condenser refrigerant temperature in deg F.
    j. Oil pressure in psig.
    k. Oil temperature in deg F.
    l. Voltage at each connection.
    m. Amperage for each phase.
    n. Kilowatt input.
    o. Crankcase heater kilowatt.
    p. Number of fans.
    q. Condenser fan rpm.
    r. Condenser fan airflow rate in cfm.
    s. Condenser fan motor make, frame size, rpm, and horsepower.
    t. Condenser fan motor voltage at each connection.
    u. Condenser fan motor amperage for each phase.

K. Air-to-Air Heat-Recovery Unit Reports:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Service.
    d. Make and type.
    e. Model and serial numbers.

2. Motor Data:

    a. 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. Sheave dimensions, center-to-center, and amount of adjustments in inches.

3. If fans are an integral part of the unit, include the following for each fan:

    a. Make and type.
    b. Arrangement and size.
    c. Sheave make, size in inches, and bore.
    d. Sheave dimensions, center-to-center, and amount of adjustments in inches.

4. Test Data (Indicated and Actual Values):

    a. Total exhaust airflow rate in cfm.
    b. Purge exhaust airflow rate in cfm.
    c. Outside airflow rate in cfm.
    d. Total exhaust fan static pressure in inches wg.
    e. Total outside-air fan static pressure in inches wg.
    f. Pressure drop on each side of recovery wheel in inches wg.
    g. Exhaust air temperature entering in deg F.
    h. Exhaust air temperature leaving in deg F.
    i. Outside-air temperature entering in deg F.
    j. Outside-air temperature leaving in deg F.
    k. Calculate sensible and total heat capacity of each airstream in MBh.

L. Instrument Calibration Reports:

1. Report Data:

    a. Instrument type and make.
    b. Serial number.
    c. Application.
    d. Dates of use.
    e. Dates of calibration.

3.13 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
2. Randomly check the following for each system:

    a. Measure airflow of at least 10 percent of air outlets.
    b. Measure water flow of at least 5 percent of terminals.
    c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
    d. Verify that balancing devices are marked with final balance position.
    e. Note deviations to the Contract Documents in the Final Report.

B. Final Inspection:

1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. TAB firm test and balance engineer shall conduct the inspection in the presence of Architect.
3. Architect shall randomly select measurements documented in the final report to be rechecked. The 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.
4. If the 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."
5. 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.
6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.14 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

3.15 SAMPLE TEST REPORTS

SAMPLE FAN TEST REPORT

Project:
Location:
System:

GENERAL	Fan		
Fan No.			
Area Served			
Manufacturer			
Model No.			
Serial No.			
Equipment Type			
Outside Air Damper Position			
MOTOR			
HP / Frame			
RPM / S.F.			
Voltage / Phase / Hertz			
Full Load Amperage			
Eff. / P.F.			
Sheave / Shaft - Diameter			
FAN			
Fan speed (low/med/high)			
Sheave / Shaft - Diameter			
Sheave Distance			
Belts (quantity and size)			
Filter (quantity and size)			
TEST DATA			
	Design	Preliminary	Final
Total Supply CFM			
Outside Air CFM			
Return Air CFM			
RPM			
Total Static Presure			
Discharge Static Pressure			
Suction Static Pressure			
Voltage			
Amperage			
BHP			

Abbreviations:
Remarks:

SAMPLE AIR OUTLET TEST REPORT

Project:
Location:
System:

Area Served	Outlet			Design CFM	Preliminary CFM	Final CFM	% of Design
	No.	Type	Size				
"Equipment Tag" Supply							
	1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	9						
	10						
TOTAL:							
"Equipment Tag" Return							
	1						
	2						
	3						
	4						
	5						
TOTAL:							

TAB CHECKLIST				
Project: Location: System:				
	Ready / Complete			
	Yes	No	Date	Comments
Air duct system is sealed. (all traverse and longitudinal seams)				
Air duct system is insulated per the contract documents				
branch duct take-offs are installed per the contract documents				
Radius elbow are turnig vanes are used at 90° bends.				
Filters are inplace and clean				
Manual damper make and model matches approved submittal				
Manual dampers are adjusted and locked				
Automatic dampers are operating and in position indicated by the controller				
Equipment and duct access doors are securely closed				
Smoke and fire dampers are installed per the contract documents				
Fan bearings are greased				
Fan belts are aligned and tight				
Verify proper rotation of fans				
Coils fins are clean and straight				
Condensate drain piping installed properly and functional				
Condensate drain piping is insulated per the contract documents				
Safety interlocks are functional				

Permanent electircal power wiring is complete				
Located equipment disconnect switches				
Electircal thermal protection is properly sized				
Automatic temperature-control systems are operational				
Thermostats are located to avoid adverse effects				
Sensors are located to sense only the intended conditions				
Equipment operates per the sequence of control				
Verify that controllers are calibrated and commissioned				
Check for variances between set points and actual measurements				
Check the operation of limiting controllers (i.e., high- and low-temperature controllers)				
Check free travel and proper operation of dampers				
Check the interaction of interlocked systems.				

END OF SECTION 230593

SECTION 230700

HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
   a. Flexible elastomeric.
   b. Mineral fiber.
2. Fire-rated insulation systems.
3. Adhesives.
4. Mastics.
5. Sealants.
6. Factory-applied jackets.
7. Field-applied jackets.
8. Tapes.
9. Securements.

B. Related Sections:
1. Division 23 Section "Metal Ducts"

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting 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 and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.4 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 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.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

G. 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 III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

H. 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 FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Mineral-Fiber, Preformed Pipe Insulation: Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 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 a NRTL acceptable to authority having jurisdiction.

2.3 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. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

E. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
4. Color: White.

2.5 SEALANTS

A. PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.6 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. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 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. Adhesive: As recommended by jacket material manufacturer.
2. Color: White
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

D. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
1. Finish and thickness are indicated in field-applied jacket schedules.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. 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. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

2.9 SECUREMENTS

A. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch or 0.135-inch diameter shank, length to suit depth of insulation indicated.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch or 0.135-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

   a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

4. 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 1-1/2 inches in diameter.

PART 3 - **EXECUTION**

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe 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. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. 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.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. 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 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. 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 as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. 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.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
   1. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
   2. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
   2. 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: Install insulation continuously through penetrations of fire-rated walls and partitions. 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 Division 07 Section "Penetration Firestopping" firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

   1. Duct: Install insulation continuously through floor penetrations that are not fire rated. 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. Pipe: Install insulation continuously through floor penetrations.
   3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Fittings and Elbows:

   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Valves and Pipe Specialties:

   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 MINERAL-FIBER INSULATION INSTALLATION

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 50 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 16 inches and smaller, no pins required.
    b. On duct sides with dimensions larger than 16 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 overcompress 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. 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.
5. 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 and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 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 16 inches and smaller, no pins required.
    b. On duct sides with dimensions larger than 16 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 overcompress 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. 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.
5. 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.

3.7 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 1-1/2-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.

3.8 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 Division 07 Section "Penetration Firestopping."

3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor supply and outdoor air.
2. Indoor return air.
3. Indoor, Type I, commercial, kitchen hood exhaust.
4. Indoor, oven and warewash exhaust.
5. Indoor, exhaust between isolation damper and penetration of building exterior.
6. Outdoor, supply and return.

B. Items Not Insulated:
1. Factory-insulated flexible ducts.
2. Factory-insulated access panels and doors.

3.10 INDOOR DUCT INSULATION SCHEDULE

A. Exposed, Supply/Neutral/Return Air, rectangular, duct insulation shall be the following:
1. Mineral-Fiber Board: 1 inches thick and 6-lb/cu. ft. nominal density.

3.11 EXTERIOR DUCT INSULATION SCHEDULE

A. New exterior ductwork shall be Thermaduct exterior duct system. See section 233113, Metal Ducts.

3.12 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.13 PIPING INSULATION SCHEDULE

A. Condensate Piping:

1. All Pipe Sizes: Insulation shall be one of the following:
a. Flexible Elastomeric: 1/2 inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

B. Refrigerant Suction, Liquid, and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:
a. Flexible Elastomeric: 1 inch thick.

C. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch thick.

3.14 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. Ducts and Plenums, Exposed.

1. Aluminum, Smooth: 0.024 inch thick.

C. Piping, Exposed:

1. PVC: 30 mils thick.

END OF SECTION 230700

SECTION 230993

SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes control sequences for the following HVAC systems, subsystems, and equipment:

1. Packaged Rooftop Unit(s).
2. Ductless split system(s)

1.2 PACKAGED ROOFTOP UNIT CONTROL SEQUENCES

A. Unit Tags:

1. RTU-1 and RTU-2

B. Fan: Shall operate during cooling, heating, economizer, and ventilation mode. Fan speed shall modulate to meet the cooling/heating demand.

C. Heating Mode: Unit shall operate to maintain the thermostat set point.

D. Cooling Mode: Unit shall operate to maintain the thermostat set point.

E. Dehumidification Mode: Unit shall operate to maintain humidity set point.

F. Economizer Mode: Unit shall operate in economizer mode to provide “free” cooling. Differential enthalpy shall be used to enable the economizer mode.

G. Ventilation: When the return air CO2 sensor measures over 1000ppm the unit outside air damper shall open (position determined during TAB) and the fan shall operate.

H. Occupied / Unoccupied: Occupied mode shall be enabled by the schedule. In occupied mode the outside air damper shall open to 10%. In unoccupied mode the outside air damper shall be fully closed. A temperature setback of 5°F shall be set up for unoccupied hours. The thermostat shall have an occupancy override button, set up for a 2 hour override.

1.3 DUCTLESS SPLIT SYSTEMS

A. System Tags:

1. FCU-1
2. FCU-2

B. Indoor Unit Fan: Shall cycle on/off base on the call for heating/cooling. Fan speed shall modulate to meet the cooling/heating demand.

C. Heating: Units shall provide heating and cooling as necessary to maintain the thermostat set point.

D. Cooling: Units shall provide heating and cooling as necessary to maintain the thermostat set point.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230993

SECTION 231123
FACILITY NATURAL GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

C. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of seismic restraints.
2. Design Calculations: Calculate requirements for selecting seismic restraints.

D. Welding certificates.

E. Field quality-control reports.

F. Operation and maintenance data.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 100 psig Insert value minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: 0.5 psig or less.

C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.4 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. 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.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.

2. End Connections: Threaded ends for NPS 2 and smaller.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. BrassCraft Manufacturing Company; a Masco company.
    b. Conbraco Industries, Inc.; Apollo Div.
    c. Lyall, R. W. & Company, Inc.
    d. McDonald, A. Y. Mfg. Co.
    e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.

7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

D. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Lee Brass Company.
    b. McDonald, A. Y. Mfg. Co.

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller.

B. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Canadian Meter Company Inc.
    b. Eaton Corporation; Controls Div.
    c. Harper Wyman Co.
    d. Maxitrol Company.

e. SCP, Inc.

3. Body and Diaphragm Case: Die-cast aluminum.
4. Springs: Zinc-plated steel; interchangeable.
5. Diaphragm Plate: Zinc-plated steel.
6. Seat Disc: Nitrile rubber.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
9. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
10. Maximum Inlet Pressure: 2 psig.

2.6 DIELECTRIC UNIONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Capitol Manufacturing Company.
2. Central Plastics Company.
3. Hart Industries International, Inc.
4. McDonald, A. Y. Mfg. Co.
5. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
6. Wilkins; Zurn Plumbing Products Group.

B. Minimum Operating-Pressure Rating: Insert pressure.

C. Combination fitting of copper alloy and ferrous materials.

D. Insulating materials suitable for natural gas.

E. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.7 SLEEVES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.8 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico Inc.

c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

2.9 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 OUTDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

C. Install fittings for changes in direction and branch connections.

D. Exterior-Wall Pipe Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

E. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.2 INDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

L. Verify final equipment locations for roughing-in.

M. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

N. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

O. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

P. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install pressure gage downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

3.3 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

3.4 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.5 HANGER AND SUPPORT INSTALLATION

A. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

B. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.6 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.7 LABELING AND IDENTIFYING

A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.8 FIELD QUALITY CONTROL

A. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.

B. Natural-gas piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 OUTDOOR PIPING SCHEDULE

A. Aboveground natural-gas piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

B. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and brazed joints. Install piping embedded in concrete with no joints in concrete.

C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.10 INDOOR PIPING SCHEDULE

A. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

3.11 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION 231123

SECTION 233113
DUCTWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Thermaduct exterior ductwork systems
3. Fabric duct
4. Sheet metal materials.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 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.

1. Static-Pressure Classes:

a. Supply Ducts (except in Mechanical Rooms): 1-inch wg.
b. Return Ducts (Negative Pressure): 1-inch wg.

2. Leakage Class:

a. Round Supply-Air Duct: 3 cfm/100 sq. ft. at 1-inch wg.
b. Rectangular Supply-Air Duct: 6 cfm/100 sq. ft. at 1-inch wg .

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

1.3 SUBMITTALS

A. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations for selecting hangers and supports.

1.4 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 – " Systems and Equipment" and Section 7 – "Construction and System Start-up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 – "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

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 1-4, "Transverse (Girth) 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 1-5, "Longitudinal Seams - Rectangular Ducts," 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 2, "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."

2.2 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: G90.

2.3 VINYL EXTERIOR DUCTWORK SYSTEM-

A. Duct shall be Thermaduct or equal. Ductwork consists of outer shell, insulation panel, and outer shell. The outer shell shall be a UV stable 1000 micron high impact resistant vinyl. The panel shall be manufactured of CFC-free closed cell rigid thermoset resin thermally bonded on both sides to a factory applied .001" (25 micron) aluminum foil facing reinforced with a fiberglass scrim. An added UV stable, IR reflective 1000-micron high impact resistant titanium infused vinyl is factory bonded using a full lamination process. The lamination process shall permanently bond the vinyl clad to the outer surfaces of the phenolic foam panel to provide a zero-permeability water-tight barrier and to form a structurally insulated panel (SIP) in which to form duct segments. Processes that do not employ a full lamination process are not acceptable. Self-applied adhesives such as tapes, caulks or cladding that incorporate pressure sensitive or spray adhesives are not acceptable. Provide insulation value of R-12.

2.4 FABRIC DUCT – Duct shall be Ductsox or approved equal.

2.5 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. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

C. 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.

D. 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.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

D. 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.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.1 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 round 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 Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.2 SEAM AND JOINT SEALING

A. Seal duct seams and joints for duct static-pressure and leakage classes specified in "Performance Requirements" Article, according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 1-2, "Standard Duct Sealing Requirements," unless otherwise indicated.

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "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 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "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 intervals 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.

3.4 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.5 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as follows:

1. Commercial Kitchen Hood Exhaust Ducts: Comply with NFPA 96.

    a. Exposed to View: Type 304, stainless-steel sheet.
    b. Concealed: Carbon-steel sheet.
    c. Welded seams and joints.

2. Dishwasher Hood Exhaust Ducts:

    a. Type 304, stainless-steel sheet.
    b. Welded seams and flanged joints with watertight EPDM gaskets.

B. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

    a. Velocity 1000 fpm or Lower:

        1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.

    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 2-3, "Vanes and Vane Runners," and Figure 2-4, "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 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "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.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

C. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: High efficiency takeoff with gasket.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals."

a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 237413

PACKAGED OUTDOOR CENTRAL STATION AIR HANDLING UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Packaged Rooftop Unit air conditioners

1.2 REFERENCES

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. AMCA 99—Standards Handbook

C. AMCA 210—Laboratory Methods of Testing Fans for Rating Purposes

D. AMCA 500—Test Methods for Louver, Dampers, and Shutters.

E. AHRI 340/360 - Unitary Large Equipment

F. NEMA MG1—Motors and Generators

G. National Electrical Code.

H. NFPA 70—National Fire Protection Agency.

I. SMACNA—HVAC Duct Construction Standards—Metal and Flexible.

J. UL 900—Test Performance of Air Filter Units.

1.3 SUBMITTALS

A. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, electrical characteristics and connection requirements.

B. Product Data:

1. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, and electrical characteristics and connection requirements.
2. Provide computer generated fan curves with specified operating point clearly plotted.
3. Manufacturer's Installation Instructions

1.4 OPERATION AND MAINTANENCE DATA

A. Maintenance Data: Provide instructions for installation, maintenance and service

1.5 QUALIFICAITONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience, who issues complete catalog data on total product.

B. Startup must be done by trained personnel experienced with rooftop equipment.

C. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters and remote controls are in place, bearings lubricated, and manufacturers' installation instructions have been followed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site.

B. Accept products on site and inspect for damage.

C. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Carrier
B. Trane
C. Daikin
D. Lennox
E. Johnson Controls, Inc

2.2 GENERAL DESCRIPTION

A. Unit performance and electrical characteristics shall be per the job schedule.

B. Configuration: Fabricate as detailed on prints and drawings:

1. Return plenum / economizer section
2. Filter section
3. Cooling coil section
4. Supply fan section
5. Gas heating section.
6. Condensing unit section

C. The complete unit shall be cETLus listed.

D. Each unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet. Each unit shall be completely factory assembled and shipped in one piece. Packaged units shall be shipped fully charged with R-410 Refrigerant and oil.

E. The unit shall undergo a complete factory run test prior to shipment. The factory test shall include a refrigeration circuit run test, a unit control system operations checkout, a unit refrigerant leak test and a final unit inspection.

F. All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.

G. Performance: All scheduled EER, IEER, capacities and face areas are minimum accepted values. All scheduled amps, kW, and HP are maximum accepted values that allow scheduled capacity to be met.

H. Warranty: The manufacturer shall provide 12-month parts only warranty. Defective parts shall be repaired or replaced during the warranty period at no charge. The warranty period shall commence at startup or six months after shipment, whichever occurs first.

2.3 CABINET, CASING, AND FRAME

A. Unit shall have a minimum R-value of 6.0.

B. Exterior surfaces shall be constructed of pre-painted galvanized steel for aesthetics and long term durability.

C. Service doors shall be provided on the fan section, filter section, control panel section, and heating vestibule in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless steel hinges and shall be secured by a latch system.

D. The unit base shall overhang the roof curb for positive water runoff and shall seat on the roof curb gasket to provide a positive, weathertight seal. Lifting brackets shall be provided on the unit base to accept cable or chain hooks for rigging the equipment.

2.4 ECONOMIZER SECTION

A. Unit shall be provided with an outdoor air economizer section. The economizer section shall include outdoor, return, and exhaust air dampers. The economizer operation shall be fully integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The outside and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be parallel blade design. Damper blades shall be gasketed with side seals to provide an air leakage rate of 1.5 cfm / square foot of damper area at 1" differential pressure in according with testing defined in AMCA 500. A barometric exhaust damper shall be provided to exhaust air out of the back of the unit. A bird screen shall be provided to prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges. Control of the dampers shall be by a factory installed direct coupled actuator. Damper actuator shall be of the modulating, spring return type. A comparative enthalpy control shall be provided to sense and compare enthalpy in both the outdoor and

return air streams to determine if outdoor air is suitable for “free” cooling. If outdoor air is suitable for “free” cooling, the outdoor air dampers shall modulate in response to the unit’s temperature control system.

B. Provide a field installed Duct/Space mounted C02 sensor. Outside air damper position will modulate between the Demand Control Ventilation Limit (minimum position setpoint) and the Ventilation Limit (maximum non-economizer position setpoint) to satisfy the space requirements. Damper position will be controlled to the greater of the two command signals, either minimum outside air flow or space IAQ (CO2).

2.5 FILTERS

A. Unit shall be provided with a draw-through filter section. The filter rack shall be designed to accept a 2” prefilter and a 4” final filter. The unit design shall have a hinged access door for the filter section. The manufacturer shall ship the rooftop unit with 2” MERV 13 construction filters. The contractor shall furnish and install, at building occupancy, the final set of filters per the contract documents.

2.6 COOLING COIL

A. The indoor coil section shall be installed in a draw through configuration, upstream of the supply air fan. The coil section shall be complete with a factory piped cooling coil and an ASHRAE 62.1 compliant double sloped drain pan.

B. The direct expansion (DX) cooling coils shall be fabricated of seamless high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row, staggered tube design with a minimum of 3 rows. All cooling coils shall have an interlaced coil circuiting that keeps the full coil face active at all load conditions. All coils shall be factory leak tested with high pressure air under water.

C. The cooling coil shall have an electronic controlled expansion valve. The unit controller shall control the expansion valve to maintain liquid subcooling and the superheat of the refrigerant system.

D. The refrigerant suction lines shall be fully insulated from the expansion valve to the compressors.

E. The drain pan shall be stainless steel and positively sloped. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The drain pan shall extend beyond the leaving side of the coil. The drain pan shall have a threaded drain connection extending through the unit base.

2.7 SUPPLY FAN

A. Supply fan shall be a double-inlet type with forward-curved blades.

B. All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment.

C. The fan motor shall be a totally enclosed motor.

2.8 HEATING SECTION

A. The rooftop unit shall include a natural gas heating section. The gas furnace design shall be one natural gas fired heating module factory installed downstream of the supply air fan in the heat section. The heating module shall be a tubular design with in-shot gas burners.

B. Each module shall have two stages of heating control. The module shall be complete with furnace controller.

C. The heat exchanger tubes shall be constructed of stainless steel.

D. The module shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.

E. Each burner module shall have two flame roll-out safety protection switches and a high temperature limit switch that will shut the gas valve off upon detection of improper burner manifold operation. The induced draft fan shall have an airflow safety switch that will prevent the heating module from turning on in the event of no airflow in the flue chamber.

2.9 CONDENSING SECTION

A. Outdoor coils shall be cast aluminum, micro-channel coils. Plate fins shall be protected and brazed between adjoining flat tubes such that they shall not extend outside the tubes. A sub-cooling coil shall be an integral part of the main outdoor air coil. Each outdoor air coil shall be factory leak tested with high-pressure air under water.

B. Fan motors shall be a totally enclosed motor. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures.

C. The condenser fan shall be low noise blade design. Fan shall be direct driven propeller type.

D. The unit shall have scroll compressors.

E. Each circuit shall be dehydrated and factory charged with Refrigerant and oil.

2.10 ELECTRICAL

A. Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with the unit shall be number and color-coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch short circuit protection, 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit. Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection. Supply fan motors shall have contactors and external overload protection. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance.

B. A single non-fused disconnect switch shall be provided for disconnecting electrical power at the unit. Disconnect switches shall be mounted internally to the control panel and operated by an externally mounted handle.

2.11 CONTROLS

A. Provide a complete integrated microprocessor system to control all unit functions including temperature control, scheduling, monitoring, unit safety protection, including compressor minimum run and minimum off times, and diagnostics.

2.12 CURB

A. A prefabricated heavy gauge galvanized steel, mounting curb shall be provided for field assembly on grade prior to unit shipment. The curb shall be a full perimeter type with complete perimeter support of the air handling section and condensing section. The curb shall be a minimum of 22" high and include a nominal 2" x 4" wood nailing strip. Gasket shall be provided for field mounting between the unit base and curb.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 237413

SECTION 238126
SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.3 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SPLIT SYSTEM AIR CONDITIONER

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Daikin Industries, LTD.
2. Mitsubishi Electronics America, Inc.; HVAC Division.
3. Sanyo Fisher (U.S.A.) Corp..
4. Samsung

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install ground-mounting, compressor-condenser components on 4-inch-thick, reinforced concrete base; 4 inches larger on each side than unit.

D. Install roof-mounting compressor-condenser components on equipment supports.

E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

F. Install piping adjacent to unit to allow service and maintenance.

G. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

H. Electrical Connections: Comply with requirements in Division 26 Sections for power wiring, switches, and motor controls.

3.2 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 238126

SECTION 260500
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contractor for this work is referred to the Drawings, Bidding Requirements, General Conditions, Special Conditions, Temporary Services and other pertinent Sections of these Specifications. These sections describe work which is a part of this Contract. The following General Provisions amplify and supplement these Sections of Specifications. In cases of conflicting requirements, the stipulations set forth in Division 1 supersede and must be satisfied by the Contractor.

1.2 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Common electrical installation requirements.

1.3 COORDINATION

A. Contractor must read the entire Specifications covering other branches of Work. Contractor is responsible for coordination of his (her) work with work performed by other trades.

B. Consult all Contract Documents which may affect the location of any equipment or apparatus furnished under this Work and make minor adjustments in location as necessary to secure coordination.

C. System layout is schematic and exact locations shall be determined by structural and other conditions. This shall not be construed to mean that the design of the system may be arbitrarily changed. The equipment layout is to fit into the building as constructed and to coordinate with equipment included under other Divisions of Work.

D. Contractor shall contact the Owner's Representative immediately if he (she) notices any discrepancies or omissions in either the Drawings or Specifications, or if there are any questions regarding the meaning or intent thereof.

E. Submit all changes, other than minor adjustments, to the Engineer/Architect for approval before proceeding with the work.

F. The Contractor is required to visit the site and fully familiarize himself or herself concerning all conditions affecting the scope of work. Failure to visit the site shall not relieve the Contractor from any responsibility in the performance of his or her Work.

G. All workmanship to be of the highest quality in accordance with the best practices of the trade by craftsmen/ craftswomen skilled in this particular work.

H. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

I. Coordinate installation of electrical boxes that are recessed in pre cast wall with precast wall manufacturer. This may require that the electrician be present at the precast wall manufacturer location during the forming of the panels. All costs associated with this coordination shall be included within the bid and no additional time or charges will be allowed to facilitate this coordination.

J. All field holes in precast wall assemblies shall be core drilled holes made in accordance with precast wall manufacturer directions.

K. All buried conduits passing from below the proposed building to the exterior shall pass below the proposed structural footing.

L. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.

M. Coordinate sleeve selection and application with selection and application of firestopping.

N. Where thermostat locations are shown, the electrical contractor shall provide a recessed wall box with conduit to an accessible location. In areas where surface mounted boxes are required, a surface mounted box and conduit to 10' AFF shall be provided (or to the equipment location, whichever is closer). Thermostat installation and the corresponding low voltage thermostat wiring shall be by the mechanical contractor.

1.4 PERMITS, INSPECTIONS AND CODES

A. File all drawings, pay all fees, and obtain permits and certificate of inspection relative to this Work.

B. Complete installation shall conform with all applicable Federal, State and Local laws, Codes and Ordinances including, but not limited to the latest approved editions of the following:

1. State Building Codes.
2. Specific Construction Safety Requirements, State Industrial Commission.
3. National Electrical Code (NFPA-70).
4. Life Safety Code, NFPA-101.
5. Occupational Safety and Health Act (OSHA) of 1971 and all amendments thereto.

C. Nothing contained in the drawings and specifications shall be construed to conflict with these laws, codes, and ordinances and they are hereby included in these specifications.

1.5 RECORD DRAWINGS

A. Record all deviations from the Drawings, on a set of prints and deliver them to the Owner and Owner's Representative upon completion of the work. Special attention to record the location of concealed boxes, service runs shall be made at the point of installation to maintain accuracy.

1. Sufficient dimensional tie points to permanent building features shall be provided for all buried conduits to facilitate future location.

1.6 INSPECTION

A. Contractor shall arrange for and include in his (her) bid, inspection of this work by the appropriate stator or local code authority having jurisdiction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Furnish new, undeteriorated materials of a quality not less than what is specified.

B. Contractor to furnish and install only those brands of equipment mentioned specifically or accepted as substitutes.

2.2 EQUIPMENT SELECTION AND APPROVAL

A. The selection of materials and equipment to be furnished shall be governed by the following:

1. Where trade names, brands of manufacturer of equipment or materials are listed in the specification, the exact equipment listed shall be used in the bid or the contractor shall submit the necessary literature to show the alternative product meets the performance characteristics of that which has been called for. Where more than one name is listed, Contractor may select any one of the various brands specified.

2.3 SUBSTITUTIONS

A. Contractor must base his (her) bid on furnishing the brands of material and equipment listed in the Specifications or their approved equals.

B. The Contractor is entitled to bid on any other equal or similar brands of material and equipment he (she) may desire to substitute. In order to be considered, the Contractor must request approval to bid the substitution in writing no later than ten (10) days prior to the Bid Date. If permitted the substitutes will be approved by addendum.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Furnish all materials, labor, tools, transportation, incidentals, and appurtenances to complete in every detail and leave in working order all items of work called for herein or shown on the accompanying Drawings.

B. Include any minor items of work necessary to provide a complete and fully operative electrical system which meets all required codes.

C. Comply with NECA 1.

D. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

E. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

F. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

G. Right of Way: Give to piping systems installed at a required slope.

3.2 PROTECTION AND CLEANING

A. Protect all fixtures and equipment against damage from leaks or abuse and pay the cost of repair or replacement of fixtures or equipment made necessary by failure to provide suitable safeguards or protection.

B. After all fixtures and equipment have been set, thoroughly clean all fixtures and equipment with manufacturers recommended cleaning agents, removing stickers and other foreign matter and leave every part in acceptable condition, clean and ready for use.

C. Repair all dents and scratches in factory prime or finish coats on all electrical equipment. If damage is excessive, replacement may be required.

END OF SECTION 260500

SECTION 260519

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. 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.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 STANDARDS

A. Insulation types, ratings and usage shall be in accordance with the National Electrical Code requirements.

B. All conductors shall be copper

C. Unless otherwise noted, minimum wire size for lighting and power branch circuits shall be No. 12 AWG. For control and auxiliary systems the minimum size shall be No. 14 AWG.

D. Conductors for emergency power and exit wiring shall be a minimum No. 12 AWG.

2.2 CONDUCTORS AND CABLES

A. All wire and cable shall be UL listed.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, XHHW, and SO.

1. THHN-THWN- 90 degree C temperature rating in dry or wet locations.

D. Multiconductor Cable: Comply with NEMA WC 70 for metal clad cable, Type MC and Type SO with ground wire.

2.3 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

B. All components used at wiring terminations, connections and splices shall be UL listed.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN, single conductors in raceway or Type XHHW, single conductors in raceway.

B. Feeders and Branch Circuits: Type THHN-THWN, single conductors in raceway.

C. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

D. Concealed light fixture whips: Metal clad cable (Type MC) limited to six feet in length.

E. Class 1 Control Circuits: Type THHN-THWN, in raceway.

F. Class 2 Control Circuits: Power-limited cable, concealed in building finishes.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Sections "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

G. Tighten electrical 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 and UL 486B.

H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice, tap conductor and equipment termination for aluminum conductors.

I. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

END OF SECTION 260519

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

B. Grounding system shall be in compliance with all requirements of the National Electrical Code.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field Quality Report

1. Photo Report
2. Dimensioned as-built locations of grounding features

1.4 QUALITY ASSURANCE

A. 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.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 5/8 inch in diameter by10 feet or as noted on the Drawings.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned copper conductor. Bury at least 24 inches below grade.

C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. A separate equipment grounding conductor, minimum size per NEC, shall be installed in each feeder, branch circuit, and control circuit conduit. Conductor insulation shall be green. DO NOT use conduit as a means for grounding of receptacles or any other such devices.

B. Conduit system shall be electrically continuous. All enclosures and non-current carrying metals to be grounded. All locknuts must cut through enameled or painted surfaces on enclosures. Where enclosures and non-current carrying metals are isolated from the conduit system, use bonding jumpers with approved clamps.

C. All new receptacles shall be bonded to a ground conductor using a #12 AEG min. bonding jumper between receptacle terminal and ground conductor. Metal-to-metal contact between the device yoke and the outlet box is not acceptable for either surface mounted boxes or flush type boxes.

D. Junction boxes and pull boxes shall be bonded by the use of UL listed ground screws or lugs.

E. Lighting fixtures shall be grounded by the use of a pigtail fastened on bare metal that is free of paint.

F. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

G. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

H. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

   1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
   2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

I. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 FIELD QUALITY CONTROL

A. Provide a photo report consisting of labeled pictures of all of the following grounding features:

1. Ground rods
2. Intersystem bonding termination
3. Grounding arrangements and connections for separately derived systems
4. Grounding connection to rebar in footing/floor
5. Grounding connection to building steel
6. Grounding connection to metallic water pipe

B. Dimensioned as-built plans showing the locations of the key grounding features contained in the photo report shall be submitted concurrently with the photo report.

END OF SECTION 260526

SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.

1.2 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Aluminum Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
2. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.

5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 SUBMITTALS

A. Product Data: For surface raceways and floor boxes.

1.4 QUALITY ASSURANCE

A. 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.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.

B. EMT: ANSI C80.3.

C. FMC: Zinc-coated steel.

D. LFMC: Flexible steel conduit with PVC jacket.

E. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Fittings for EMT: Steel, set-screw or compression type. Die cast fittings are not acceptable.

F. LFMC: Flexible steel conduit with PVC jacket. Made from a continuous length of galvanized cold rolled steel strip, spirally wound. Adjacent strips shall have locked typed construction with all the edges turned in. With an extruded PVC jacket.

2.2 NONMETALLIC CONDUIT AND TUBING

A. PVC conduit shall be heavy wall, Schedule 40 ultra-violet resistant, UL listed under Standard 651. Conduit shall be suitable for use with 90 degree C insulated wire. Conduit fittings and cement shall be of the same manufacturer.

B. Fittings for Schedule 40 PVC: Match to conduit or tubing type and material.

2.3 METAL WIREWAYS

A. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Wireway Covers: Screw-cover type.

D. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

A. Surface Metal Raceways:

1. Description: Aesthetically pleasing, nonmetallic, low-profile multiple channel raceway system with quarter round trim cover and deep device plates.

    a. Basis of Design: Wiremold Access 5000 Series Raceway

        1) Base: 5000B
        2) Cover: 5000C
        3) Quarter Round Trim: 5000T
        4) Device Plate: 5007C-1A
        5) Deep Device Plate: 5007C-2AB
        6) End Cap: 5010R or 5010L
        7) Internal Base Elbow with cover: 5017B and 5017C
        8) External Base Elbow with cover: 5018B and 5018C
        9) Face Plates: 5507 Series

2. Color: White
3. Two-compartment divided raceway
4. Assembled dimensions +/- 6”W x 1”H
5. Provide with all fittings, boxes, end terminations, dividers necessary to provide layout shown on the Drawings.
6. Power and data entry into surface raceway shall be by rear entry wall box connector.

2.5 BOXES AND ENCLOSURES

A. Sheet Metal Outlet and Device Boxes: NEMA OS 1,

B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

C. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Green.
2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC.", "TELEPHONE.", “COMMUNICATIONS as appropriate for services contained.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

2.7 SLEEVES FOR RACEWAYS

A. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

B. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

C. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid Steel Conduit.
2. Concealed Conduit: EMT.
3. Underground Conduit: Schedule 40 PVC, direct buried.

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. All other exposed areas: RMC.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC
5. Damp or Wet Locations: RMC.
6. Raceways for Optical Fiber or Communications Cable: EMT.
7. Boxes and Enclosures: NEMA 250, Type 1, except as noted on the Drawings.

C. Minimum Raceway Size: 3/4-inch trade size Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. In finished areas, conduit must be concealed above accessible ceilings, within the building structure, or within chases. Exposed conduits to be run tight to wall or ceiling and installed in a neat workmanlike manner, ready for painting.

C. Install conduit parallel or perpendicular to building lines (except where run in or below floor slabs). Keep conduit runs as closed to underside of structure as possible.

D. Exercise necessary precautions to prevent accumulation of water, dirt, or concrete in conduits during execution of electrical work. Conduit in which water or foreign material has been permitted to accumulate shall be thoroughly cleaned, or replaced where such accumulations cannot be removed.

E. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

F. Complete raceway installation before starting conductor installation.

G. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

H. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

I. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

J. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

K. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Change from ENT rigid steel conduit before rising above the floor.

L. Raceways below slabs:

1. Minimum conduit size shall be 1".
2. Change from PVC conduit to rigid steel conduit before rising above floor.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

N. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 240-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

O. Raceways for Optical Fiber and Communications Cable: Install as follows:

1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

P. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

Q. Covers for all junction boxes containing emergency circuits shall be red and labeled according to "260553 Identification for Electrical Systems."

R. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

S. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

1. Wall boxes in tile, marble, brick or other finished masonry wall shall be of welded construction and designed for installation within masonry.

T. Set metal floor boxes level and flush with finished floor surface.

U. Metal boxes cast in concrete shall be designed for concrete installation.

V. Weather-proof boxes shall be die cast aluminum.

W. Boxes for exposed work in finished area to be Type FS with threaded hubs and rigid conduit risers.

X. Install expansion fittings at all locations where conduits cross building expansion joints.

Y. Secure rigid conduit at cabinets and boxes using insulated throat type grounding and bonding bushings. Locknuts shall be tightened to cut through painted surfaces.

Z. Where a number of conduits are to be run exposed and parallel, one with another, they shall be grouped and supported by trapeze hangers or unistrut racks tight to the building structure.

AA. Mount junction and pull boxes securely to building structure in a location that meets the requirements of the National Electrical Code for accessibility and work space clearance. Coordinate exact locations of work with other trades. Unless noted otherwise, mounting heights shall be (all measurements are to the top of the box):

Switches, receptacles, or telephone/data shown above a countertop	12" above countertop
Dedicated receptacles (i.e. refrigerator, microwave, etc.)	To suit equipment (see equipment/cabinetry elevation drawings where applicable)
Other interior receptacles	16" AFF
Exterior receptacles	20" above finished grade
Other switches	48" AFF
Telephone/data shown next to a doorway	56" AFF
Other telephone/data	16" AFF

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit (not concrete encased):

1. Install direct buried conduit according to Division 31 requirements for conduit installation.
2. Absent Division 31 requirements or if the following is more stringent, install direct buried conduit as follows:

    a. Excavate by open cut unless otherwise directed on the Drawings.
    b. Excavate to the depths necessary to provide at least the NEC required minimum burial depths upon project completion.
    c. Over-excavate organic, soft, spongy, or otherwise unsuitable soils found at or below the bottom of the trench to meet firm subsoil.
    d. Trenches in non-pavement and non structure areas:

        1) After installing conduit, backfill and compact utilizing native backfill material. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction leaving a mound on the surface to accommodate future settling.

e. Trenches under pavement or structures and within 5'-0" of same:

1) After installing conduit, backfill with compacted aggregate to 95% standard proctor density in 8" maximum lifts. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling.

3. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

4. Warning Planks: Bury warning tape approximately 12 inches above direct-buried conduits.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 260533

SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Identification for conductors and communication and control cable.
2. Data/Telephone outlet labels
3. Receptacle labels
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with 29 CFR 1910.145.

1.4 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Marker Tape: Vinyl or vinyl -cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 DATA/TELEPHONE OUTLET LABELS

A. Machine printed paper insert with black filled lettering located under clear label cover on face of plate and durable wire markers on inside of outlet box.

2.3 RECEPTACLE LABELS

A. Hot stamped or engraved machine printing with black filled lettering on face of plate and durable wire markers on inside of outlet box.

2.4 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.5 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Color Scheme

1. Emergency Warning labels: White background with red letters
2. All other warning labels: Yellow background with black letters

D. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
3. Service Equipment emergency sources warning: “CAUTION – TWO SOURCES OF SUPPLY- EMERGENCY POWER SOURCE LOCATED IN GENERATOR ROOM 207 ON NORTH SIDE OF BUILDING.”
4. Generator Warning Label: “EMERGENCY GENERATOR”
5. Automatic Transfer Switch Warning Label: “EMERGENCY TRANSFER SWITCH”
6. Emergency Panel Warning Label: “ EMERGENCY PANEL”
7. Junction boxes containing emergency circuits: “EMERGENCY CIRCUITS- PANEL *insert name”*
8. As noted on drawings.

2.6 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face. (White letters on red background for emergency information)
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.7 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for fasteners, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

B. Fasteners for Labels: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

B. Covers for all junction boxes containing emergency circuits shall be red.

PART 3 - EXECUTION

3.1 APPLICATION

A. Auxiliary Electrical Systems Conductor and Cable Identification: Use marker tape to identify field-installed alarm, control, signal, sound, intercommunications, voice, and data wiring connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and cable pull points. Identify by system and circuit designation.
2. Use system of designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

B. Data/Telephone Outlet Identification: Use outlet labels to identify each outlet connection. Use system of designation that is uniform and consistent with cable identification. Label face of plate and wire markers inside of box,

C. Receptacle Identification: Use labels to identify panelboard and circuit number from which served. Label face of plate and wire markers inside of box,

D. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

E. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.

2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

F. Instruction Signs:

1. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for emergency shut down of generator or remote operation of main switch.

G. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Engraved, laminated acrylic or melamine label, drilled for screw attachment. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label, drilled for screw attachment.
c. Elevated Components: Increase sizes of labels and legend to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:

a. Panelboards, electrical cabinets, and enclosures.
b. Electrical switchgear and switchboards.
c. Transformers.
d. Generators
e. Disconnect switches.
f. Power transfer equipment.
g. Contactors.
h. Timeclocks
i. Fire alarm control panel and annunciators
j. Motor control switches including Hand/Off/Auto switches

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded feeder, and branch-circuit conductors.

1. Color shall be factory applied or for sizes larger than No. 10 AWG field applied
2. Colors for 208/120-V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.

3. Colors for 480/277-V Circuits:

    a. Phase A: Brown.
    b. Phase B: Orange.
    c. Phase C: Yellow.

4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

END OF SECTION 260553

SECTION 260574

FAULT CURRENT, OVERCURRENT PROTECTIVE DEVICE COORDINATION, AND ARC FLASH HAZARD STUDIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes computer-based, fault-current, overcurrent protective device coordination, and arc flash hazard studies. .

B. The fault current study shall be completed prior to ordering equipment to verify the adequacy of the equipment to meet the available fault current conditions.

C. Protective devices shall be set based on results of the protective device coordination study.

D. Arc flash warning labels shall be installed on equipment based on the results of the arc flash hazard study.

1.3 SUBMITTALS

A. Study Reports: Submit (3) hard copies and a digital copy of each report.

1. Coordination-study input data, including completed computer program input data sheets.
2. Study and Equipment Evaluation Reports.
3. Coordination-Study Report.
4. Arc flash hazard report

1.4 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.

B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.

D. Comply with IEEE 399 for general study procedures.

E. Comply with IEEE 1584 and NFPA 70E for arc flash hazard calculations

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

A. Comply with IEEE 399 and IEEE1584.

B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

PART 3 - EXECUTION

3.1 POWER SYSTEM DATA

A. Gather and tabulate the following input data to support coordination study:

1. Product Data for overcurrent protective devices specified in other Division 26 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Impedance of utility service entrance.
3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:

    a. Circuit-breaker and fuse-current ratings and types.
    b. Relays and associated power and current transformer ratings and ratios.
    c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
    d. Generator kilovolt amperes, size, voltage, and source impedance.
    e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
    f. Busway ampacity and impedance.
    g. Motor horsepower and code letter designation according to NEMA MG 1.

4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:

    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.

g. Time-current-characteristic curves of devices indicated to be coordinated.
h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

3.2 FAULT-CURRENT STUDY

A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:

1. Electric utility's supply termination point
2. Main switchboard
3. Generators and transfer switches
4. Distribution panelboard.
5. Branch circuit panelboard.
6. Local motor disconnect

B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

C. Calculate momentary and interrupting duties on the basis of maximum available fault current.

D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 241 and IEEE 242.

1. Transformers:

a. ANSI C57.12.22.
b. IEEE C57.12.00.
c. IEEE C57.96.

2. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
3. Low-Voltage Fuses: IEEE C37.46.

E. Study Report:

1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.

F. Equipment Evaluation Report:

1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.

3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. Equipment evaluation report shall be completed prior to ordering electrical equipment and devices to ensure that the interrupting ratings of the equipment are sufficient for the available fault currents.

3.3 COORDINATION STUDY

A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.

1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.

B. Comply with IEEE 241 recommendations for fault currents and time intervals.

C. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

a. Inrush current when first energized.
b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

D. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

E. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:

1. Tabular Format of Settings Selected for Overcurrent Protective Devices:

a. Device tag.
b. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
c. Fuse-current rating and type.

2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

a. Device tag.
b. Voltage and current ratio for curves.

c. Three-phase and single-phase damage points for each transformer.
d. No damage, melting, and clearing curves for fuses.
e. Cable damage curves.
f. Transformer inrush points.
g. Maximum fault-current cutoff point.

F. Completed data sheets for setting of overcurrent protective devices.

3.4 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.

B. The flash protection boundary and the incident energy shall be calculated at all equipment locations shown on the one-line diagram.

C. Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm2.

D. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations

E. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.

F. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

G. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.

H. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

I. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

J. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

K. Prepare a written report indicating the following results of the incident energy and flash protection boundary calculations including:

1. Arcing fault magnitude
2. Protective device clearing time
3. Duration of arc
4. Arc flash boundary
5. Working distance
6. Incident energy
7. Hazard Risk Category
8. Recommendations for arc flash energy reduction
9. Tabular Format of Settings Selected for Overcurrent Protective Devices:

L. Arc Flash Warning Labels

1. The contractor of the Arc Flash Hazard Analysis shall provide and install a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed. Label shall be waterproof and UV-resistant.
2. All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the owner and after any system changes, upgrades or modifications have been incorporated in the system.
3. The label shall include the following information, at a minimum:

    a. Location designation
    b. Nominal voltage
    c. Flash protection boundary
    d. Hazard risk category
    e. Incident energy
    f. Working distance
    g. PPE class required
    h. Engineering report number, revision number and issue date.

4. Labels shall be machine printed, with no field markings.
5. One arc flash label shall be provided for each piece of equipment shown in the one-line diagram.

END OF SECTION 260574

SECTION 262413
SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Surge Protective Devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.

1.3 SUBMITTALS

A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards.
6. Include schematic and wiring diagrams for power, signal, and control wiring.

C. Operation and Maintenance Data: Provide (3) hard copies in separate 3-ring binders and an electronic copy. Include the following:

1. Routine maintenance requirements for switchboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
3. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. 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.

C. Comply with NEMA PB 2.

D. Comply with NFPA 70.

E. Comply with UL 891.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handle and prepare switchboards for installation according to NEMA PB 2.1.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Square D; a brand of Schneider Electric.

B. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Sections front and rear aligned.

C. Nominal System Voltage: 480Y/277 V. 4-Wire

D. Main-Bus Continuous: 1,200 amps as shown on the drawings.

E. Outdoor Enclosures: Type 3R.

1. Finish: Factory-applied finish in manufacturer's standard color; undersurfaces treated with corrosion-resistant undercoating.
2. Enclosure: Downward, rearward sloping roof; bolt-on rear covers for each section.

F. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

G. Phase Buses and Connections: Three phase, four wire.

1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated, with tin-plated aluminum or copper feeder circuit-breaker line connections.
2. Ground Bus: Minimum size required by UL 891, hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors.
3. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections.
4. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.

2.2 SURGE PROTECTIVE DEVICES

A. Integral Surge Protection Device and all components shall be designed, manufactured, and tested in accordance with latest applicable standards.

1. IEEE C62.41-compliant,
2. ANSI/UL 1283 5th Edition or later

B. General Requirements

1. Type 2
2. 20 kA Nominal discharge current
3. Unit operating voltage matching switchboard
4. Maximum Continuous Operating Voltage (MCOV) shall not be less than 115% of the nominal system operating volrage
5. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards. End of life mode to be open circuit. Unit with end of life short-circuit mode are not acceptable.
6. Unit shall operate without the need for an external overcurrent protection device (OCPD), and be listed by UL as such. Unit must not require external OCPD or replaceable internal OCPD for the UL Listing.
7. Protection Modes – The SPD must protect all modes of the electrical system being utilized.

    a. L-N, L-G, L-L, and N-G

8. Voltage Protection Rating (VPR): The maximum ANSI/UL 1449 4th Edition VPR for the device shall not exceed:

    a. L-L: 2000V
    b. L-N, L-G, N-G: 1,200V

C. SPD Design

1. Maintenance Free Design – The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable single-mode modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
2. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
3. Electrical Noise Filter – Each Type 2 unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.

    a. Type 1 units shall not contain filtering or have a UL 1283 5th Edition Listing.

4. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.
5. Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:

    a. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.
    b. For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.
    c. For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes
    d. The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.

6. Audible Alarm and Silence Button – The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.
7. Thermal MOV Protection

    a. The unit shall contain thermally protected MOVs. These self-protected MOVs shall have a thermal protection element integrated with the MOV and a mechanical disconnect with arc quenching capabilities in order to achieve overcurrent protection of the MOV. The thermal protection assembly shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

8. Fully Integrated Component Design – All of the SPD's components and diagnostics shall be contained within one discrete assembly. The use of plug in single-mode modules that

must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.

9. Safety Requirements

    a. The SPD shall minimize potential arc flash hazards by containing no single-mode plug in user serviceable / replaceable parts and shall not require periodic maintenance. SPDs containing items such as replaceable single-mode plug in modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
    b. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.

10. Peak Single-Impulse Surge Current Rating: 125 kA per mode/250 kA per phase
11. SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.
12. The SPD shall be of the same manufacturer as the switchgear, switchboard, MCC, or busway
13. The SPD shall be factory installed integral to the switchgear, switchboard, MCC, and/or bus plug at the assembly plant by the original equipment manufacturer
14. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
15. The SPD shall be connected through a disconnect sized by the manufacturer (circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.
16. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

2. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
3. Provide with Arc Flash Reduction Maintenance Switch accessory. The Arc Flash Reduction Maintenance Switch shall allow the operator to enable a maintenance mode with a present accelerated instantaneous override trip to reduce arc flash energy.
4. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.

b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
c. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
d. Shunt Trip: 120-V trip coil energized from control power circuit (when remote disconnect button is pushed), set to trip at 55 percent of rated voltage.
e. Capable of being locked in both the off and on position via external padlock.

2.4 INSTRUMENTATION

A. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:

1. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.

2.5 CONTROL POWER

A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.

B. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

C. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.6 ACCESSORY COMPONENTS AND FEATURES

1. Condensation heater:

a. Provide thermostatically controlled condensation heater within enclosure to prevent condensation at the expected operating temperatures. Power shall be internally derived.

2. Remote Disconnect Button:

a. Momentary pushbutton for remote opening of main breaker. Button shall be provided with a cover to prevent accidental operation.
b. Locate button as shown on Drawings.

2.7 IDENTIFICATION

A. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Receive, inspect, handle, store and install switchboards and accessories according to NEMA PB2.1.

B. Equipment Mounting: Install switchboards on concrete base, as shown in Project Drawings.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Install filler plates in unused spaces of panel-mounted sections.

E. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study."

END OF SECTION 262413

SECTION 262416
PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Distribution panelboards.

1.3 SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.

5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. 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.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Outdoor Locations: NEMA 250, Type 3R.
b. Or as noted on the plans

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Finishes:

a. Panels and Trim: Steel and galvanized steel factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Galvanized steel.

5. Directory Card: Inside panelboard door, mounted in transparent card holder.

B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses:

1. Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.

3. Ground Lugs and Bus Configured Terminators: Mechanical type.

4. Feed-Through Lugs (When required): Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

5. Subfeed (Double) Lugs (When required): Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

E. Service Equipment Label (When applicable): NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

D. Mains: Circuit breaker or main lugs only as noted on Drawings.

E. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
3. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.

b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

c. Shunt Trip (When indicated): 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
d. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
e. Handle Padlocking Device (When indicated): Fixed attachment, for locking circuit-breaker handle in on or off position.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Receive, inspect, handle, store and install panelboards and accessories according to NEMA PB 1.1.

B. Mount panelboard cabinet plumb and rigid without distortion of box.

C. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

D. Install filler plates in unused spaces.

E. Recessed panels: Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.

F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

G. Comply with NECA 1.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

END OF SECTION 262416

SECTION 262816
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

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. This Section includes the following individually mounted, enclosed switches and circuit breakers:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.3 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current rating.

1.4 QUALITY ASSURANCE

A. 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.

B. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Square D/Group Schneider.

B. Fusible Switch, 600 A and Smaller: NEMA KS 1, Type Heavy Duty, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Non-fusible Switch, 600 A and Smaller: NEMA KS 1, Type Heavy Duty Duty, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors. (If required)

2.3 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor Locations: NEMA 250, Type 3R.
2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
4. As noted in the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Identification for Electrical Systems."

3.3 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 262816

1. GENERAL

1.1. WORK INCLUDED

A. The General Contractor shall provide a chain link fence including all accessory and hardware items necessary to complete the fencing assembly. The system shall be a nominal seven-foot (7') fence (7’) fabric, no barbed wire.

1. All components to be PVC/vinyl black coated

B. The fence shall not be installed until the site preparation processes have been completed
1. Remove existing fence bollards or site features, and fill voids with flowable fill or compacted fill suitable for new boring operations.

1.2. SUBMITTALS

A. Provide Shop Drawings accurately describing the fencing components and layout.

1.3. QUALITY ASSURANCE

A. All products shall comply with the standards set forth by the Chain Link Manufacturer’s Institute.

2. PRODUCTS

2.1. MATERIALS

A. Fabric: The fabric will be 9 gauge aluminized or galvanized steel woven fabric, black pvc/polymer coated in a two inch (2") mesh with knuckled selvedges X 7'-0" high.

B. Line Posts: Line posts shall be hot dip galvanized posts, black pvc/polymer coated 2.875” outside diameter, Schedule 40.

C. Terminal Posts: Terminal and gatepost shall be galvanized, black pvc/polymer coated 4" outside diameter, Schedule 40.

D. Gate support posts to be nominal 6” (5 9/16”), galvanized, black pvc/polymer coated, schedule 40

E. Rails and Braces: The rails and braces shall be Type I, 1.66", galvanized pipe, black pvc/polymer coated or equal. Provide top rail all around. Brace at corner posts, gates, and 100' intervals.

F. Post Tops: Posts shall be capped, black pvc coated.

G. Tension Wire: Tension wire shall be twisted and aluminized or galvanized, black pvc coated, steel, 7 gauge wire continuous along the bottom.

H. Tees, Clips and Accessories: Tees, clips and accessories shall be as needed for the assembly, galvanized or aluminized as is standard with the Manufacturer's system. Secure fabric at top and bottom at intervals not exceeding 15" along all posts, rails and tension wires.

I. Barbed Wire: none

J. Gates: detailed, design and brace for normal commercial duty, black pvc/polymer coated components.

1. Position gates in conference with owner and HVAC contractor for best service access.
2. Gates to be pair x8' wide north and south enclosures, but subject to final coordination with site obstacles and service access.
3. Both gates in pairs to have drop bar to secure in position.
4. Provide gate hardware with pad lock hasp.

K. Gate components, rollers counterbalance, gate latch and lock for pad lock, manufacturer's standard for heavy duty daily use, smooth manual operation.

3. EXECUTION

3.1. WORKMANSHIP

A. Work shall be first class. The fabric shall be tightly stretched and secured. Posts shall be vertical in alignment, properly spaced, and all components rigidly assembled. Gate shall operate smoothly without binding or sagging. Any of the work deemed not acceptable by the Architect/Engineer shall be replaced.

1. Wire shall generally follow grade in a uniform smooth flowing line
2. Avoid abrupt changes in line
3. Hold fabric 1½" to 3" above grade to allow mowing and trimming.

B. Posts shall be set with concrete holes as detailed with a minimum depth of forty-two inches (42"). Hole sides shall be uniform. Form and pour with smooth sides. DO NOT LET TOP OF CONCRETE BULGE OUT TO FORM A FROST LEDGE.

1. Hold below finish paving surfaces for Bituminous
2. Core or PVC sleeve paving.
3. Visit site to determine the extent of coring needed

C. The line posts shall be at 10'-0" on center maximum. Provide an additional brace rail and tie at each corner and gate.

D. Where slabs or mechanical equipment pads occur, the posts shall be set into the concrete such that concrete extends out past fence line three inches (3").

E. Where there is pre-existing paving fence posts excavation are to be cored for attractive install.

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