

Project Manual

Project:

“Cranbury Public Library”

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Cranbury, NJ 08512*

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Invitation For Bids

LEGAL NOTICE Cranbury Public Library

PUBLIC NOTICE is hereby given that sealed Bids will be received by the **Cranbury Public Library** (hereinafter called the Owner), **on the public plaza outside the front (east) entrance to the Cranbury Town Hall Building, 23-A North Main Street, Cranbury, New Jersey 08512, on Thursday, March 4, 2021 at 11:00 AM** prevailing time. All Bids shall be delivered by hand. No bids will be received after the time and date specified and no bids will be received by mail. Bids shall be received by courier service (date and time recorded) or shall be hand delivered on the day of the bid opening; a Library representative will be available outside of Town Hall one (1) hour prior to the bid opening to receive hand-delivered bids. All Bids will be opened publicly and read aloud at that time. Appropriate social distancing measures will be practiced among all participants.

The Owner shall award the Contract or reject all bids within 60 days of bid opening, except that the bids of any bidders who consent thereto may, at the request of the Owner, be held for consideration for such longer period as may be agreed. The Owner reserves the right to waive any informalities in bids and to reject any and all bids if it is in the best interest of the Owner to do so.

Separate sealed bids for: GENERAL CONTRACT: CRANBURY PUBLIC LIBRARY

All work incidental thereto, including but not limited to the new Cranbury Public Library and as required in accordance with the Project Manual.

All questions regarding the project should be directed to the Architect and received in writing only via email to: office@aiarchs.com. We strongly encourage questions to be received by February 18, 2021 to be answered by addenda before February 23, 2021.

Bidders electing to receive the specifications from a third party, or any other service or entity assume the responsibility of ensuring they receive any issued revisions or addenda.

Bids must be accompanied by a guarantee in the amount of 10% of the bid, but not in excess of \$20,000.00, in the form of a certified check, cashier's check or bid bond.

Bids must be accompanied by consent of surety regardless of whether a check or Bid Bond is submitted. The Successful Bidder will be required to furnish an acceptable Performance and Labor and Material Payment Bond.

The Bid Documents may be obtained directly from the Architect's office as an electronic PDF document. Bidders must request bid documents via email at office@aiarchs.com.

Bidders must be authorized to do business in New Jersey. Any Bidder which is a corporation not chartered under the laws of the State of New Jersey, must submit an affidavit certifying that said corporation is authorized to do business in the State of New Jersey.

Bidders must be registered with the Department of Labor and are required to comply with the requirements of Public Law 1999, c.238, "The Public Works Contractor Registration Act", which became effective on April 11, 2000.

Bidders, their subcontractors and suppliers, must comply with the New Jersey Business Registration requirements.

Bidders are required to comply with the requirements of Public Law 1975, c. 127 which pertains to "Non-Discrimination" and "Affirmative Actions", and Public Law 1977, c. 33, which requires a Statement of Corporate Ownership.

Bidders are required to comply with the requirements of N.J.S.A. 10:5-31 et. seq. and N.J.A.C. 17:27.

Kirstie Venanzi, President Library Board of Trustees
Cranbury Public Library
30 Main Street
Cranbury, NJ 08512

Instructions To Bidders And Statutory Requirements

I. SUBMISSION OF BIDS

- A. Sealed bids shall be received by the contracting unit, hereinafter referred to as “owner,” in accordance with public advertisement as required by law, with a copy of said notice being attached hereto and made a part of these specifications.
- B. Sealed bids will be received by the designated representative at the time and location as stated in the Invitation to Bidders, and at such time and place will be publicly opened and read aloud.
- C. The bid shall be submitted in a sealed envelope: (1) addressed to the owner, (2) bearing the name and address of the bidder written on the face of the envelope, and (3) clearly marked "BID" with the contract title and/or bid # being bid.
- D. It is the bidder's responsibility that bids are presented to the owner at the time and at the place designated. Bids may be hand delivered or mailed; however, the owner disclaims any responsibility for bids forwarded by regular or overnight mail. If the bid is sent by express mail service, the designation in sub-section C, above, must also appear on the outside of the express mail envelope. Bids received after the designated time and date will be returned unopened.
- E. Bidders may request that their bids be withdrawn within five business days of bid opening in accordance with N.J.S.A. 40A:11-23-3.
- F. All prices and amounts must be written in ink or preferably machine-printed. Bids containing any conditions, omissions, unexplained erasures or alterations, items not called for in the bid proposal form, attachment of additive information not required by the specifications, or irregularities of any kind, may be rejected by the owner. Any changes, whiteouts, strikeouts, etc. in the bid must be initialed in ink by the person signing the bid.
- G. Each bid proposal form must give the full business address, business phone, fax, e-mail if available, the contact person of the bidder, and be signed by an authorized representative as follows:
- Bids by partnerships must furnish the full name of all partners and must be signed in the partnership name by one of the members of the partnership or by an authorized representative, followed by the signature and designation of the person signing.
 - Bids by corporations must be signed in the legal name of the corporation, followed by the name of the State in which incorporated and must contain the signature and designation of the president, secretary or other person authorized to bind the corporation in the matter.
 - Bids by sole-proprietorship shall be signed by the proprietor.
 - When requested, satisfactory evidence of the authority of the officer signing shall be furnished.
- H. Bidder should be aware of the following statutes that represent “Truth in Contracting” laws:
- N.J.S.A. 2C:21-34, et seq. governs false claims and representations by bidders. It is a serious crime for the bidder to knowingly submit a false claim and/or knowingly make material misrepresentation.
 - N.J.S.A. 2C:27-10 provides that a person commits a crime if said person offers a benefit to a public servant for an official act performed or to be performed by a public servant, which is a violation of official duty.
 - N.J.S.A. 2C:27-11 provides that a bidder commits a crime if said person, directly or indirectly, confers or agrees to confer any benefit not allowed by law to a public servant.
 - Bidder should consult the statutes or legal counsel for further information.

II. BID SECURITY AND BONDING REQUIREMENTS

A. BID GUARANTEE

Bidder shall submit with the bid a certified check, cashier's check or bid bond in the amount of ten percent (10%) of the total price bid, but not in excess of \$20,000, payable unconditionally to the owner. When submitting a Bid Bond, it shall contain Power of Attorney for full amount of Bid Bond from a surety company authorized to do business in the State of New Jersey and acceptable to the owner. The check or bond of the unsuccessful bidder(s) shall be returned pursuant to N.J.S.A. 40A:11-24a. The check or bond of the bidder to whom the contract is awarded shall be retained until a contract is executed and the required performance bond or other security is submitted. The check or bond of the successful bidder shall be forfeited if the bidder fails to enter into a contract pursuant to N.J.S.A. 40A:11-21.

Failure to submit a bid guarantee shall result in rejection of the bid.

B. CONSENT OF SURETY

Bidder shall submit with the bid a Certificate (Consent of Surety) with Power of Attorney for full amount of bid price from a Surety Company authorized to do business in the State of New Jersey and acceptable to the owner stating that it will provide said bidder with a Performance Bond in the full amount of the bid. This certificate shall be obtained in order to confirm that the bidder to whom the contract is awarded will furnish Performance and Payment Bonds from an acceptable surety company on behalf of said bidder, any or all subcontractors or by each respective subcontractor or by any combination thereof which results in performance security equal to the total amount of the contract, pursuant to N.J.S.A. 40A:11-22.

Failure to submit a consent of surety form shall result in rejection of the bid.

C. LABOR AND MATERIAL (PAYMENT) BOND

Bidder shall with the delivery of the performance bond submit an executed payment bond to guarantee payment to laborers and suppliers for the labor and material used in the work performed under the contract.

Failure to submit a labor and material bond with the performance bond shall be cause for declaring the contract null and void.

D. MAINTENANCE BOND

Upon acceptance of the work by the owner, the contractor shall submit a maintenance bond (N.J.S.A. 40A:11-16.3) in an amount equal to 100% of the project costs guaranteeing against defective quality of work or materials for the period of 1 year.

The performance bond provided shall not be released until final acceptance of the whole work and then only if any liens or claims have been satisfied. The surety on such bond or bonds shall be a duly authorized surety company authorized to do business in the State of New Jersey pursuant to N.J.S.A. 17:31-5.

III. INTERPRETATION AND ADDENDA

- A. The bidder understands and agrees that its bid is submitted on the basis of the specifications prepared by the owner. The bidder accepts the obligation to become familiar with these specifications.
- B. Bidders are expected to examine the specifications and related bid documents with care and observe all their requirements. Ambiguities, errors or omissions noted by bidders should be promptly reported in writing to the appropriate official. Any prospective bidder who wishes to challenge a bid specification shall file such challenges in writing with the contracting agent no less than three business days prior to the opening of the bids. Challenges filed after that time shall be considered void and having no impact on the contracting unit or the award of a contract pursuant to N.J.S.A. 40A:11-13. In the event the bidder fails to notify the owner of such ambiguities, errors or omissions, the bidder shall be bound by the requirements of the specifications and the bidder's submitted bid.
- C. No oral interpretation and or clarification of the meaning of the specifications for any goods and services will be made to any bidder. Such request shall be in writing, addressed to the owner's representative stipulated in the specification. In order to be given consideration, a written request must be received at least seven (7) business days prior to the date fixed for the opening of the bid for goods and services.

All interpretations, clarifications and any supplemental instructions will be in the form of written addenda to the specifications, and will be distributed to all prospective bidders. All addenda so issued shall become part of the specification and bid documents, and shall be acknowledged by the bidder in the bid. The owner's interpretations or corrections thereof shall be final.

When issuing addenda, the owner shall provide required notice prior to the official receipt of bids to any person who has submitted a bid or who has received a bid package pursuant to N.J.S.A. 40A:11-23(c) (2).

D. Discrepancies in Bids

- 1. If the amount shown in words and its equivalent in figures do not agree, the written words shall be binding. Ditto marks are not considered writing or printing and shall not be used.
- 2. In the event that there is a discrepancy between the unit prices and the extended totals, the unit prices shall prevail. In the event there is an error of the summation of the extended totals, the computation by the owner of the extended totals shall govern.

E. Pre-Bid Meeting

A pre-bid meeting is not required for this project.

IV. BRAND NAMES, STANDARDS OF QUALITY AND PERFORMANCE

- A. Brand names and/or descriptions used in these specifications are to acquaint bidders with the types of goods and services desired and will be used as a standard by which goods and services offered as equivalent will be evaluated.
- B. Variations between the goods and services described and the goods and services offered are to be fully identified and described by the bidder on a separate sheet and submitted with the bid proposal form. Vendor literature WILL NOT suffice in explaining exceptions to these specifications. In the absence of any exceptions by the bidder, it will be presumed and required that the goods and services as described in the bid specification be provided or performed.
- C. It is the responsibility of the bidder to document and/or demonstrate the equivalency of the goods and services offered. The owner reserves the right to evaluate the equivalency of the goods and services.
- D. In submitting its bid, the bidder certifies that the goods and services to be furnished will not infringe upon any valid patent or trademark and that the successful bidder shall, at its own expense, defend any and all actions or suits charging such infringement, and will save the owner harmless from any damages resulting from such infringement.
- E. Only manufactured and farm products of the United States, wherever available, shall be used pursuant to N.J.S.A. 40A:11-18.

- F. The contractor shall guarantee any or all goods and services supplied under these specifications. Defective or inferior goods shall be replaced at the expense of the contractor. The contractor will be responsible for return freight or restocking charges.

V. INSURANCE AND INDEMNIFICATION

A. INSURANCE REQUIREMENTS

1. Worker's Compensation Insurance

Workers Compensation insurance shall be maintained in full force during the life of the contract, covering all employees engaged in performance of the contract pursuant to N.J.S.A. 34:15-12(a) and N.J.A.C. 12:235-1.6.

2. General Liability Insurance

General liability insurance shall be provided with limits of not less than \$3,000,000, any one person and \$3,000,000, any one accident for bodily injury and \$3,000,000, aggregate for property damage, and shall be maintained in full force during the life of the contract.

3. Automotive Liability Insurance

Automobile Liability insurance covering the use of all owned, non-owned, hired or leased automobiles with limits of liability not less than \$3,000,000 combined single limit for bodily injury and property damage. Coverage should include uninsured and underinsured motorist at limits no less than the minimum statutory limits.

4. Excess Liability Umbrella

Excess Liability Umbrella insurance shall be provided with limits of not less than \$5,000,000 each occurrence and \$5,000,000 aggregate.

B. CERTIFICATES OF THE REQUIRED INSURANCE

Certificates of Insurance for those policies required above shall be submitted with the contract. Such coverage shall be with an insurance company authorized to do business in the State of New Jersey and shall name the owner as an additional insured.

Self-insured contractors shall submit an affidavit attesting to their self-insured coverage and shall name the owner as an additional insured.

C. INDEMNIFICATION

Bidder shall indemnify and hold harmless the owner from all claims, suits or actions, and damages or costs of every name and description to which the owner may be subjected or put by reason of injury to the person or property of another, or the property of the owner, resulting from negligent acts or omissions on the part of the contractor, the contractor's agents, servants or subcontractors in the delivery of goods and services, or in the performance of the work under the contract.

VI. PRICING INFORMATION FOR PREPARATION OF BIDS

- A. The owner is exempt from any local, state or federal sales, use or excise tax.

- B. Contractor shall be responsible for obtaining any applicable permits or licenses from any government entity that has jurisdiction to require the same. All bids submitted shall not include this cost.

- C. Bidders shall provide prices for furnishing goods and services required by these specifications. Prices shall be net, including any charges for packing, crating, containers, etc. All transportation charges shall be fully prepaid by the contractor, F.O.B. destination and placement at locations specified by the owner. As specified, placement may require inside deliveries. No additional charges will be allowed for any transportation costs resulting from partial shipments made for the contractor's convenience.

VII. STATUTORY AND OTHER REQUIREMENTS

A. MANDATORY AFFIRMATIVE ACTION CERTIFICATION

No firm may be issued a contract unless it complies with the affirmative action provisions of N.J.S.A. 10:5-31 et seq. and N.J.A.C. 17:27-1 et seq. The following information summarizes the full, required regulatory text, which is included as Exhibit B of this bid specification.

1. Goods and Services (including professional services) Contracts

Each contractor shall submit to the public agency, after notification of award but prior to execution of a goods and services contract, one of the following three documents:

- i. A photocopy of a valid letter that the contractor is operating under an existing Federally approved or sanctioned affirmative action program (good for one year from the date of the letter); or
- ii. A photocopy of a Certificate of Employee Information Report approval, issued in accordance with N.J.A.C. 17:27-4; or
- iii. A photocopy of an Employee Information Report (Form AA 302) provided by the Division and distributed to the public agency to be completed by the contractor in accordance with N.J.A.C. 17:27-4.

2. Maintenance/Construction Contracts

- a. After notification of award, but prior to signing the contract, the contractor shall submit to the public agency compliance officer and the Division of Contract Compliance and Equal Employment Opportunity in Public Contracts (Division) an initial project workforce report (Form AA201) provided to the public agency by the Division for distribution to and completion by the contractor, in accordance with N.J.A.C. 17:27-7.5.
- b. The contractor shall also submit a copy of the Monthly Project Workforce Report once a month thereafter for the duration of the contract to the Division and to the public agency compliance officer. The contractor shall also cooperate with the public agency in the payment of budgeted funds, as is necessary, for on-the job and/or off-the-job programs for outreach and training of minorities and women.

B. AMERICANS WITH DISABILITIES ACT OF 1990

Discrimination on the basis of disability in contracting for the purchase of goods and services is prohibited. Bidders are required to read Americans With Disabilities language that is included as Appendix A of this specification and agree that the provisions of Title II of the Act are made a part of the contract. The contractor is obligated to comply with the Act and to hold the owner harmless.

C. STATEMENT OF OWNERSHIP DISCLOSURE

N.J.S.A. 52:25-24.2 provides that no corporation or partnership shall be awarded any contract for the performance of any work or the furnishing of any goods and services, unless, prior to the receipt of the bid or accompanying the bid of said corporation or partnership. Bidders shall submit a statement setting forth the names and addresses of all stockholders in the corporation or partnership who own ten percent or more of its stock of any class, or of all individual partners in the partnership who own a ten percent or greater interest therein. The included Statement of Ownership shall be completed and attached to the bid proposal. This requirement applies to all forms of corporations and partnerships, including, but not limited to, limited partnerships, limited liability corporations, limited liability partnerships and Subchapter S corporations. Failure to submit a stockholder disclosure document shall result in rejection of the bid.

D. PROOF OF BUSINESS REGISTRATION

N.J.S.A. 52:32-44 requires that each bidder (contractor) submit proof of business registration prior to award of contract. Proof of registration shall be a copy of the bidder's Business Registration Certificate (BRC). A BRC is obtained from the New Jersey Division of Revenue. Information on obtaining a BRC is available on the internet at www.nj.gov/njbgs or by phone at (609) 292-1730. N.J.S.A. 52:32-44 imposes the following requirements on contractors and all subcontractors that **knowingly** provide goods or perform services for a contractor fulfilling this contract:

- 1) The contractor shall provide written notice to its subcontractors and suppliers to submit proof of business registration to the contractor;
- 2) Prior to receipt of final payment from a contracting agency, a contractor must submit to the contracting agency an accurate list of all subcontractors or attest that none was used;
- 3) During the term of this contract, the contractor and its affiliates shall collect and remit, and shall notify all subcontractors and their affiliates that they must collect and remit to the Director, New Jersey Division of Taxation, the use tax due pursuant to the Sales and Use Tax Act, (N.J.S.A. 54:32B-1 et seq.) on all sales of tangible personal property delivered into this State.

A contractor, subcontractor or supplier who fails to provide proof of business registration or provides false business registration information shall be liable to a penalty of \$25 for each day of violation, not to exceed \$50,000 for each business registration not properly provided or maintained under a contract with a contracting agency. Information on the law and its requirements is available by calling (609) 292-1730.

E. DISCLOSURE OF INVESTMENT ACTIVITIES IN IRAN – (See Disclosure Form in bid package)

1. Bidders shall comply with the requirements of N.J.S.A. 40A:11-2.1 and N.J.S.A. 52:32-55 et seq. (P.L. 2012, Chap. 25) respecting the disclosure of investment activities in Iran. Any person or entity that submits a bid or otherwise proposes to enter into or renew a contract must complete the certification provided herewith, under penalty of perjury, that the person or entity, or one of the person's or entity's parents, subsidiaries, or affiliates, is not identified on a list created and maintained by the Department of the Treasury as a person or entity engaging in investment activities in Iran.

F. NEW JERSEY WORKER AND COMMUNITY RIGHT TO KNOW ACT

The manufacturer or supplier of chemical substances or mixtures shall label them in accordance with the N.J. Worker and Community Right to Know Law (N.J.S.A. 34:5A-1 et seq., and N.J.A.C 8:59-2 et seq.). Containers that the law and rules require to be labeled shall show the Chemical Abstracts Service number of all the components and the chemical name. Further, all applicable Material Safety Data Sheets (MSDS) - hazardous substance fact sheet - must be furnished.

G. PREVAILING WAGE ACT

Pursuant to N.J.S.A. 34:11-56.25 et seq., contractors on projects for public work shall adhere to all requirements of the New Jersey Prevailing Wage Act. The contractor shall be required to submit a certified payroll record to the owner within ten (10) days of the payment of the wages. The contractor is also responsible for obtaining and submitting all subcontractors' certified payroll records within the aforementioned time period. The contractor shall submit said certified payrolls. It is the contractor's responsibility to obtain any additional copies of the certified payroll form to be submitted by contacting the New Jersey Department of Labor and Workforce Development, Division of Workplace Standards. Additional information is available at www.state.nj.us/labor/Isse/Ispubcon.html.

H. THE PUBLIC WORKS CONTRACTOR REGISTRATION ACT

N.J.S.A. 34:11-56.48 et seq. requires that a general or prime contractor and any listed subcontractors named in the contractor's bid proposal shall possess a certificate *at the time the bid proposal is submitted*. After bid proposals are received and prior to award of contract, the successful contractor shall submit a copy of the contractor's certification along with those of all listed subcontractors. All non-listed subcontractors and lower tier sub-subcontractors shall be registered prior to starting work on the project. It is the general contractor's responsibility that all non-listed sub-contractors at any tier have their certificate prior to starting work on the job.

Under the law a "contractor" is "a person, partnership, association, joint stock company, trust, corporation or other legal business entity or successor thereof who enters into a contract" which is subject to the provisions of the New Jersey Prevailing Wage Act N.J.S.A. 34:11-56.25, et seq. It applies to contractors based in New Jersey or in another state.

The law defines "public works projects" as contracts for "public work" as defined in the Prevailing Wage statute [N.J.S.A. 34:11-56.26(5)]. The term means:

- "Construction, reconstruction, demolition, alteration, or repair work, or maintenance work, including painting and decorating, done under contract and paid for in whole or in part out of the funds of a public body, except work performed under a rehabilitation program.

- "Public work" shall also mean construction, reconstruction, demolition, alteration, or repair work, done on any property or premises, whether or not the work is paid for from public funds..."
- "Maintenance work" means the repair of existing facilities when the size, type or extent of such facilities is not thereby changed or increased. While "maintenance" includes painting and decorating and is covered under the law, it does not include work such as routine landscape maintenance or janitorial services.

To register, a contractor must provide the State Department of Labor with a full and accurately completed application form. The form is available online at www.state.nj.us/labor/lssc/lspubcon.html.

N.J.S.A. 34:11-56.55 specifically prohibits accepting applications for registration as a substitute for a certificate of registration.

I. NON-COLLUSION AFFIDAVIT

The Affidavit shall be properly executed and submitted with the bid proposal.

J. PAY TO PLAY

1. All business entities are advised of their responsibility to file an annual disclosure statement of political contributions with the New Jersey Election Law Enforcement Commission (ELEC) pursuant to N.J.S.A. 19:44A-20.27 if they receive contracts in excess of \$50,000 from public entities in a calendar year.
2. Business entities are responsible for determining if filing is necessary. Additional information on this requirement is available from ELEC at 888-313-3532 or at www.elec.state.nj.us.

VIII. METHOD OF CONTRACT AWARD

- A. Pursuant to requirements of N.J.A.C. 5:30-5.1 et seq., any contract resulting from this bid shall be subject to the availability and appropriation of sufficient funds annually. Please see Section X, Termination of Contract, Sub-section E, for additional information.
- B. If the award is to be made on the basis of a base bid only, it shall be made to that responsible bidder submitting the lowest base bid.
- C. If the award is to be made on the basis of a combination of a base bid with selected options, it shall be made to that responsible bidder submitting the lowest net bid.
- D. The owner may also elect to award the contract on the basis of unit prices.
- E. The form of contract shall be submitted by the owner to the successful bidder. Terms of the specifications/bid package prevail. Bidder exceptions must be formally accepted by the owner.

IX. CAUSES FOR REJECTING BIDS

Bids may be rejected for any of the following reasons:

- A. All bids pursuant to N.J.S.A. 40A:11-13.2;
- B. If more than one bid is received from an individual, firm or partnership, corporation or association under the same name;
- C. Multiple bids from an agent representing competing bidders;
- D. The bid is inappropriately unbalanced;
- E. The bidder is determined to possess, pursuant to N.J.S.A. 40A:11-4(b), Prior Negative Experience; or,

- F. If the successful bidder fails to enter into a contract within 21 days, Sundays and holidays excepted, or as otherwise agreed upon by the parties to the contract. In this case at its option, the owner may accept the bid of the next lowest responsible bidder. (N.J.S.A. 40A:11-24b)

X. TERMINATION OF CONTRACT

- A. If, through any cause, the contractor shall fail to fulfill in a timely and proper manner obligations under the contract or if the contractor shall violate any of the requirements of the contract, the owner shall there upon have the right to terminate the contract by giving written notice to the contractor of such termination and specifying the effective date of termination. Such termination shall relieve the owner of any obligation for balances to the contractor of any sum or sums set forth in the contract. Owner will pay only for goods and services accepted prior to termination.
- B. Notwithstanding the above, the contractor shall not be relieved of liability to the owner for damages sustained by the owner by virtue of any breach of the contract by the contractor and the owner may withhold any payments to the contractor for the purpose of compensation until such time as the exact amount of the damage due the owner from the contractor is determined.
- C. The contractor agrees to indemnify and hold the owner harmless from any liability to subcontractors/suppliers concerning payment for work performed or goods supplied arising out of the lawful termination of the contract by the owner under this provision.
- D. In case of default by the contractor, the owner may procure the goods or services from other sources and hold the contractor responsible for any excess cost.
- E. Continuation of the terms of the contract beyond the fiscal year is contingent on availability of funds in the following year's budget. In the event of unavailability of such funds, the owner reserves the right to cancel the contract.
- F. ACQUISITION, MERGER, SALE AND/OR TRANSFER OF BUSINESS, ETC.

It is understood by all parties that if, during the life of the contract, the contractor disposes of his/her business concern by acquisition, merger, sale and or/transfer or by any means convey his/her interest(s) to another party, all obligations are transferred to that new party. In this event, the new owner(s) will be required to submit all documentation/legal instruments that were required in the original bid/contract. Any change shall be approved by the Owner.

- G. The contractor will not assign any interest in the contract and shall not transfer any interest in the same without the prior written consent of the owner.
- H. The owner may terminate the contract for convenience by providing 60 calendar days advanced notice to the contractor.

XI. PAYMENT

- A. No payment will be made unless duly authorized by the Owner's authorized representative and accompanied by proper documentation.
- B. Payment will be made in accordance with the Owner's policy and procedures, and applicable state statutes.

XII. CONTRACT TIME

- A. Contract Time shall be **Three Hundred Sixty Five (365) calendar days.**

XIII. LIQUIDATED DAMAGES

- A. Liquidated Damages: **\$300.00 per day.**

EXHIBIT B
MANDATORY EQUAL EMPLOYMENT OPPORTUNITY LANGUAGE
N.J.S.A. 10:5-31 et seq. (P.L. 1975, C. 127)
N.J.A.C. 17:27
CONSTRUCTION CONTRACTS

During the performance of this contract, the contractor agrees as follows:

The contractor or subcontractor, where applicable, will not discriminate against any employee or applicant for employment because of age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Except with respect to affectional or sexual orientation and gender identity or expression, the contractor will ensure that equal employment opportunity is afforded to such applicants in recruitment and employment, and that employees are treated during employment, without regard to their age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Such equal employment opportunity shall include, but not be limited to the following: employment, up-grading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Public Agency Compliance Officer setting forth provisions of this nondiscrimination clause.

The contractor or subcontractor, where applicable will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex.

The contractor or subcontractor will send to each labor union, with which it has a collective bargaining agreement, a notice, to be provided by the agency contracting officer, advising the labor union or workers' representative of the contractor's commitments under this act and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

The contractor or subcontractor, where applicable, agrees to comply with any regulations promulgated by the Treasurer, pursuant to N.J.S.A. 10:5-31 et seq., as amended and supplemented from time to time and the Americans with Disabilities Act.

When hiring or scheduling workers in each construction trade, the contractor or subcontractor agrees to make good faith efforts to employ minority and women workers in each construction trade consistent with the targeted employment goal prescribed by N.J.A.C. 17:27-7.2; provided, however, that the Division may, in its discretion, exempt a contractor or subcontractor from compliance with the good faith procedures prescribed by the following provisions, A, B and C, as long as the Division is satisfied that the contractor or subcontractor is employing workers provided by a union which provides evidence, in accordance with standards prescribed by the Division, that its percentage of active "card carrying" members who are minority and women workers is equal to or greater than the targeted employment goal established in accordance with N.J.A.C. 17:27-7.2. The contractor or subcontractor agrees that a good faith effort shall include compliance with the following procedures:

(A) If the contractor or subcontractor has a referral agreement or arrangement with a union for a construction trade, the contractor or subcontractor shall, within three business days of the contract award, seek assurances from the union

that it will cooperate with the contractor or subcontractor as it fulfills its affirmative action obligations under this contract and in accordance with the rules promulgated by the Treasurer pursuant to N.J.S.A. 10:5-31 et. seq., as supplemented and amended from time to time and the Americans with Disabilities Act. If the contractor or subcontractor is unable to obtain said assurances from the construction trade union at least five business days prior to the commencement of construction work, the contractor or subcontractor agrees to afford equal employment opportunities minority and women workers directly, consistent with this chapter. If the contractor's or subcontractor's prior experience with a construction trade union, regardless of whether the union has provided said assurances, indicates a significant possibility that the trade union will not refer sufficient minority and women workers consistent with affording equal employment opportunities as specified in this chapter, the contractor or subcontractor agrees to be prepared to provide such opportunities to minority and women workers directly, consistent with this chapter, by complying with the hiring or scheduling procedures prescribed under (B) below; and the contractor or subcontractor further agrees to take said action immediately if it determines that the union is not referring minority and women workers consistent with the equal employment opportunity goals set forth in this chapter.

(B) If good faith efforts to meet targeted employment goals have not or cannot be met for each construction trade by adhering to the procedures of (A) above, or if the contractor does not have a referral agreement or arrangement with a union for a construction trade, the contractor or subcontractor agrees to take the following actions:

(1) To notify the public agency compliance officer, the Division, and minority and women referral organizations listed by the Division pursuant to N.J.A.C. 17:27-5.3, of its workforce needs, and request referral of minority and women workers;

(2) To notify any minority and women workers who have been listed with it as awaiting available vacancies;

(3) Prior to commencement of work, to request that the local construction trade union refer minority and women workers to fill job openings, provided the contractor or subcontractor has a referral agreement or arrangement with a union for the construction trade;

(4) To leave standing requests for additional referral to minority and women workers with the local construction trade union, provided the contractor or subcontractor has a referral agreement or arrangement with a union for the construction trade, the State Training and Employment Service and other approved referral sources in the area;

(5) If it is necessary to lay off some of the workers in a given trade on the construction site, layoffs shall be conducted in compliance with the equal employment opportunity and non-discrimination standards set forth in this regulation, as well as with applicable Federal and State court decisions;

(6) To adhere to the following procedure when minority and women workers apply or are referred to the contractor or subcontractor:

(i) The contractor or subcontractor shall interview the referred minority or women worker.

(ii) If said individuals have never previously received any document or certification signifying a level of qualification lower than that required in order to perform the work of the construction trade, the contractor or subcontractor shall in good faith determine the qualifications of such individuals. The contractor or subcontractor shall hire or schedule those individuals who satisfy appropriate qualification standards in conformity with the equal employment opportunity and non-discrimination principles set forth in this

chapter. However, a contractor or subcontractor shall determine that the individual at least possesses the requisite skills, and experience recognized by a union, apprentice program or a referral agency, provided the referral agency is acceptable to the Division. If necessary, the contractor or subcontractor shall hire or schedule minority and women workers who qualify as trainees pursuant to these rules. All of the requirements, however, are limited by the provisions of (C) below.

(iii) The name of any interested women or minority individual shall be maintained on a waiting list, and shall be considered for employment as described in (i) above, whenever vacancies occur. At the request of the Division, the contractor or subcontractor shall provide evidence of its good faith efforts to employ women and minorities from the list to fill vacancies.

(iv) If, for any reason, said contractor or subcontractor determines that a minority individual or a woman is not qualified or if the individual qualifies as an advanced trainee or apprentice, the contractor or subcontractor shall inform the individual in writing of the reasons for the determination, maintain a copy of the determination in its files, and send a copy to the public agency compliance officer and to the Division.

(7) To keep a complete and accurate record of all requests made for the referral of workers in any trade covered by the contract, on forms made available by the Division and submitted promptly to the Division upon request.

(C) The contractor or subcontractor agrees that nothing contained in (B) above shall preclude the contractor or subcontractor from complying with the union hiring hall or apprenticeship policies in any applicable collective bargaining agreement or union hiring hall arrangement, and, where required by custom or agreement, it shall send journeymen and trainees to the union for referral, or to the apprenticeship program for admission, pursuant to such agreement or arrangement. However, where the practices of a union or apprenticeship program will result in the exclusion of minorities and women or the failure to refer minorities and women consistent with the targeted county employment goal, the contractor or subcontractor shall consider for employment persons referred pursuant to (B) above without regard to such agreement or arrangement; provided further, however, that the contractor or subcontractor shall not be required to employ women and minority advanced trainees and trainees in numbers which result in the employment of advanced trainees and trainees as a percentage of the total workforce for the construction trade, which percentage significantly exceeds the apprentice to journey worker ratio specified in the applicable collective bargaining agreement, or in the absence of a collective bargaining agreement, exceeds the ratio established by practice in the area for said construction trade. Also, the contractor or subcontractor agrees that, in implementing the procedures of (B) above, it shall, where applicable, employ minority and women workers residing within the geographical jurisdiction of the union.

After notification of award, but prior to signing a construction contract, the contractor shall submit to the public agency compliance officer and the Division an initial project workforce report (Form AA 201) electronically provided to the public agency by the Division, through its website, for distribution to and completion by the contractor, in accordance with N.J.A.C. 17:27-7. The contractor also agrees to submit a copy of the Monthly Project Workforce Report once a month thereafter for the duration of this contract to the Division and to the public agency compliance officer.

The contractor agrees to cooperate with the public agency in the payment of budgeted funds, as is necessary, for on-the-job and/or off-the-job programs for outreach and training of minorities and women.

(D) The contractor and its subcontractors shall furnish such reports or

other documents to the Division of Public Contracts Equal Employment Opportunity Compliance as may be requested by the Division from time to time in order to carry out the purposes of these regulations, and public agencies shall furnish such information as may be requested by the Division of Public Contracts Equal Employment Opportunity Compliance for conducting a compliance investigation pursuant to **Subchapter 10 of the Administrative Code (NJAC 17:27)**

APPENDIX A
AMERICANS WITH DISABILITIES ACT OF 1990
Equal Opportunity for Individuals with Disability

The contractor and the **Cranbury Public Library** (hereafter "owner") do hereby agree that the provisions of Title 11 of the Americans With Disabilities Act of 1990 (the "Act") (*42 U.S.C. 5121 01 et seq.*), which prohibits discrimination on the basis of disability by public entities in all services, programs, and activities provided or made available by public entities, and the rules and regulations promulgated pursuant there unto, are made a part of this contract. In providing any aid, benefit, or service on behalf of the owner pursuant to this contract, the contractor agrees that the performance shall be in strict compliance with the Act. In the event that the contractor, its agents, servants, employees, or subcontractors violate or are alleged to have violated the Act during the performance of this contract, the contractor shall defend the owner in any action or administrative proceeding commenced pursuant to this Act. The contractor shall indemnify, protect, and save harmless the owner, its agents, servants, and employees from and against any and all suits, claims, losses, demands, or damages, of whatever kind or nature arising out of or claimed to arise out of the alleged violation. The contractor shall, at its own expense, appear, defend, and pay any and all charges for legal services and any and all costs and other expenses arising from such action or administrative proceeding or incurred in connection therewith. In any and all complaints brought pursuant to the owner's grievance procedure, the contractor agrees to abide by any decision of the owner which is rendered pursuant to said grievance procedure. If any action or administrative proceeding results in an award of damages against the owner, or if the owner incurs any expense to cure a violation of the ADA which has been brought pursuant to its grievance procedure, the contractor shall satisfy and discharge the same at its own expense.

The owner shall, as soon as practicable after a claim has been made against it, give written notice thereof to the contractor along with full and complete particulars of the claim, If any action or administrative proceeding is brought against the owner or any of its agents, servants, and employees, the *owner shall* expeditiously forward or have forwarded to the contractor every demand, complaint, notice, summons, pleading, or other process received by the owner or its representatives.

It is expressly agreed and understood that any approval by the owner of the services provided by the contractor pursuant to this contract will not relieve the contractor of the obligation to comply with the Act and to defend, indemnify, protect, and save harmless the owner pursuant to this paragraph.

It is further agreed and understood that the owner assumes no obligation to indemnify or save harmless the contractor, its agents, servants, employees and subcontractors for any claim which may arise out of their performance of this Agreement. Furthermore, the contractor expressly understands and agrees that the provisions of this indemnification clause shall in no way limit the contractor's obligations assumed in this Agreement, nor shall they be construed to relieve the contractor from any liability, nor preclude the owner from taking any other actions available to it under any other provisions of the Agreement or otherwise at law.

STATE OF NEW JERSEY

DEPARTMENT OF LABOR & WORKFORCE DEVELOPMENT
CONSTRUCTION EEO COMPLIANCE MONITORING PROGRAM

FORM AA-201

Revised 11/11

INITIAL PROJECT WORKFORCE REPORT CONSTRUCTION

Official Use Only

Assignment

Code

For instructions on completing the form, go to: http://www.state.nj.us/treasury/contract_compliance/pdf/aa201ins.pdf

1. FID NUMBER	2. CONTRACTOR ID NUMBER	5. NAME AND ADDRESS OF PUBLIC AGENCY AWARDDING CONTRACT Name: Address:			
3. NAME AND ADDRESS OF PRIME CONTRACTOR (Name) (Street Address) (City) (State) (Zip Code)		CONTRACT NUMBER DATE OF AWARD DOLLAR AMOUNT OF AWARD		6. NAME AND ADDRESS OF PROJECT Name: Address:	
4. IS THIS COMPANY MINORITY OWNED [] OR WOMAN OWNED []		COUNTY		7. PROJECT NUMBER	
9. TRADE OR CRAFT		PROJECTED TOTAL EMPLOYEES		PROJECTED MINORITY EMPLOYEES	
		MALE FEMALE		MALE FEMALE	
		J AP	J AP	J AP	J AP
				8. IS THIS PROJECT COVERED BY A PROJECT LABOR AGREEMENT (PLA)? YES <input type="checkbox"/>	
				PROJECTED PHASE - IN DATE	
				PROJECTED COMPLETION DATE	
1. ASBESTOS WORKER					
2. BRICKLAYER OR MASON					
3. CARPENTER					
4. ELECTRICIAN					
5. GLAZIER					
6. HVAC MECHANIC					
7. IRONWORKER					
8. OPERATING ENGINEER					
9. PAINTER					
10. PLUMBER					
11. ROOFER					
12. SHEET METAL WORKER					
13. SPRINKLER FITTER					
14. STEAMFITTER					
15. SURVEYOR					
16. TILER					
17. TRUCK DRIVER					
18. LABORER					
19. OTHER					
20. OTHER					

I hereby certify that the foregoing statements made by me are true. I am aware that if any of the foregoing statements are willfully false, I am subject to punishment.

(Signature)

10. (Please Print Your Name)

(Title)

(Area Code)

(Telephone Number)

(Ext.)

(Date)

Bid Form

A. PROJECT TITLE & LOCATION: **Cranbury Public Library**
 30 Park Place West
 Cranbury, NJ 08512

B. BID TO: **Cranbury Town Hall**
 23-A North Main Street
 Cranbury, NJ 08512

C. PROPOSAL:

Authorized Name & Title: _____

Firm Name: _____

Federal Tax ID #: _____

Address: _____

Telephone/Fax: _____/Fax _____

Email Address: _____

Pursuant to the Project Manual relating to the “**Cranbury Public Library**” project, and in compliance with the Bid Documents, the undersigned Bidder, having become thoroughly familiar with the terms and conditions of the Bid and Contract Documents, which include the Instructions to Bidders, the Bid Forms, the Project Manual, all as prepared by Arcari + Iovino Architects, P.C., as well as the Addenda acknowledged below, having understood the local conditions affecting performance and cost of the Work at this site, hereby proposes and agrees to fully perform the Work in strict accordance with the Contract Documents.

To wit, all labor, materials, services and equipment, including tools, machinery and supplies, permit fees, if any, and all taxes, if any, and specified insurance necessary to perform and complete the entire Work as set forth in and in accordance with the said Documents, for the sum of:

UNIT COSTS: Refer to Specifications as well as all Drawings for full descriptions of work related herein.

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Extended Price</u>
1	Concrete Sidewalk	SY	243	_____	_____
2	Bituminous Sidewalk	SY	90	_____	_____
3	Bituminous Pavement	SY	1320	_____	_____
4	Fire Truck Access Drive	SY	578	_____	_____
5	Curbing	LF	255	_____	_____
6	Curb Stop	UNITS	10	_____	_____
7	‘B’ Inlet	UNIT	1	_____	_____
8	‘E’ Inlet	UNIT	1	_____	_____
9	4’ Manhole	UNIT	1	_____	_____

10	5' Manhole	UNIT	1	_____	_____
11	FES (18")	UNIT	1	_____	_____
12	4' x 4' OCS	UNIT	1	_____	_____
13	12" RCP	LF	243	_____	_____
14	15" CL V RCP	LF	64	_____	_____
15	18" CL V RCP	LF	131	_____	_____
16	18" RCP	LF	64	_____	_____
17	8" HDPE	LF	468	_____	_____
18	4" Storm C/O	UNITS	2	_____	_____
19	8" Storm C/O	UNITS	15	_____	_____
20	4" SAN.PVC	LF	18	_____	_____
21	6" SAN.PVC	LF	321	_____	_____
22	6" SAN.C/O	UNIT	5	_____	_____
23	SAN. Doghouse MH	UNIT	1	_____	_____
24	Water Meter	UNIT	1	_____	_____
25	1 1/2" HDPE Water Service	LF	91	_____	_____
26	Gas Connection	LS	1	_____	_____
27	Electric/Tele/Cable Connection	LF	115	_____	_____
28	Light Bollards	UNIT	4	_____	_____
29	Light Fixtures	UNITS	3	_____	_____
30	Soil Erosion and Sediment Control	LS	1	_____	_____
31	Ornamental Trees and Evergreens – 4'-5'	UNITS	2	_____	_____
32	Ornamental Trees and Evergreens – 5'-6'	UNITS	7	_____	_____
33	Shrubs – 24"; 3 gal.	UNITS	101	_____	_____
34	Shrubs – 30" – 42"; 5 gal.	UNITS	36	_____	_____
35	Shrubs – 4'-5'; B&B	UNITS	1	_____	_____
36	Groundcover – 8"-12"; 1 gal.	UNITS	169	_____	_____
37	Perennials – 8"-12"; 1 gal.	UNITS	140	_____	_____
38	Perennials – 12"-15"; 1 gal.	UNITS	23	_____	_____
39	Shade Trees – 3"-3 1/2"	UNITS	3	_____	_____
40	Evergreens – 5'-6'	UNITS	17	_____	_____
41	Trees – Dappled Willow – 3'-4'	UNITS	3	_____	_____
42	Trees – Sweetbay Magnolia – 4'-5'	UNITS	3	_____	_____
43	Trees – Clump River Birch – 5'-6'	UNITS	2	_____	_____
44	Groundcover – 1 Quart Container	UNITS	4860	_____	_____
45	Shrubs – 12"-15"; 2 gal.	UNITS	138	_____	_____
46	Shrubs – 15"-18"; 2 gal.	UNITS	16	_____	_____

SUBTOTAL OF UNIT COSTS: _____

47 All other work not listed above that is described
in the Drawings & Specifications _____

TOTAL BASE BID (SUM OF ITEMS #1 – 47) _____

_____ Dollars
(Written)

D. ALTERNATES: Refer to Specification Section 012300-Alternates, as well as Drawings, for full descriptions of Alternate work related herein:

ALTERNATE No. 1: (Circulation Desk): Provide and install the millwork as shown on the Contract Drawings. Include all blocking, fasteners, etc. required for installation.

Add the sum of: _____ Dollars(\$ _____)
(Written) (Figure)

ALTERNATE No. 2: (Circulation Storage Cabinets): Provide and install the millwork as shown on the Contract Drawings. Include all blocking, fasteners, etc. required for installation.

Add the sum of: _____ Dollars(\$ _____)
(Written) (Figure)

ALTERNATE No. 3: (Reference): Provide and install the millwork as shown on the Contract Drawings. Include all blocking, fasteners, etc. required for installation.

Add the sum of: _____ Dollars(\$ _____)
(Written) (Figure)

ALTERNATE No. 4: (Building Signage): Provide and install the building signage as shown on the Contract Drawings. Include all blocking, fasteners, etc. required for installation.

Add the sum of: _____ Dollars(\$ _____)
(Written) (Figure)

E. ADDENDA: Receipt of the following Addenda acknowledged:

Addendum No. _____ Dated _____

Addendum No. _____ Dated _____

F. ATTACHMENTS: Enclosed within the Project Manual are the following attachments to this Bid Form. These attachments are to be executed fully and submitted with this Bid Form:

- a. Bid Form
- b. Acknowledgement of Receipt of Addenda
- c. Bid Security Form
- d. Consent of Surety
- e. Bidder's Qualification Form
- f. Plan and Equipment Questionnaire
- g. List of Subcontractors
- h. Non-Collusion Affidavit

- i. Statement of Ownership Disclosure
- j. Disclosure of Investment Activities in Iran
- k. Certification of Non-Debarment for Federal Government Contracts
- l. Certification by Bidder Regarding Equal Employment Opportunity
- m. Affidavit for Affirmative Action Plan
- n. NJ Business Registration Requirements
- o. Public Works Contractor Registration Act Statement
- p. Bid Document Submission Checklist

G. EXECUTION:

The undersigned Bidder further represents that the above Bid remains in full force and effect for not less than Sixty (60) calendar days after the submission date, and that should be awarded the Contract, the Bidder will enter into an Owner - Contractor Agreement, will start and complete the Work per the time set in the Agreement.

The undersigned hereby declares that only the person or persons interested in the Proposal as principal or principals, is or are named below, and that no other person than herein below named has any interest in the Proposal. The Proposal is made without any connection with any other person or persons making a proposal for the same purpose. The Proposal is in all respects fair and without collusion or fraud and that no officer of the **Cranbury Public Library** is, shall be, or will become directly or indirectly, interested as a contracting party, partner, stockholder, surety or otherwise in the performance of the contract, or in the supplies, work, or business to which it relates.

It is further declared that the site of the work and the Contract Documents have been examined by the undersigned and it is also agreed that the work will be carried out and completed, if this Proposal is accepted, as specified and the undersigned will provide all the Superintendents, Labor, Material, Tools and Equipment, all Taxes, Specified Insurance, and all else necessary therefore, and incidental thereto for the items in the Proposal, complete in place, at the price per unit of measure for each scheduled item of work stated in the Schedule of Prices following.

Accompanying this Proposal is a Consent of Surety and a certified check, cashier's check, or bid bond for a minimum of ten (10%) percent of the amount of bid but not greater than \$20,000 payable to the Owner, which is agreed by the undersigned to be forfeited as liquidated damages, and not as a penalty, if the Contract is awarded to the undersigned, and the undersigned shall fail to execute the Contract for the work within the stipulated time, otherwise, the bid security shall be returned to the undersigned as specified in the Contract Documents.

Signed _____
(Bidder's Signature) (Date)

(Corporate Seal)

ACKNOWLEDGEMENT OF RECEIPT OF ADDENDA

Cranbury Public Library
(Name of Local Contracting Unit)

Cranbury Public Library
(Name of Construction/Public Works Project)

Project #1404
(Project or Bid Number)

Pursuant to N.J.S.A. 40A: 11-23(c.)(1),(2), & (3), the undersigned Contractor hereby acknowledges receipt of the following notices, revisions, or addenda to the quote advertisement, specifications or quote documents. By indicating date of receipt, Contractor acknowledges the submitted quotation takes into account the provisions of the notice, revision or addendum. Note that the local unit's record of notice to Contractor's shall take precedence and that failure to include provisions of changes in a quote proposal may be subject for rejection of the quote.

If no notices, revisions or addenda have been received the undersigned bidder must acknowledge so by writing 'NONE' in the box below.

Local Unit Reference Number or Title of Notice, Revision or Addenda	How Received (mail, fax, pick-up, etc.)	Date Received

No addenda were received

Acknowledgement by Contractor:

Name of Bidder: _____

By Authorized Representative:

Signature: _____

Printed Name and Title: _____

Date: _____

Bid Security Form

This proposal is accompanied by a bid security in the form of a guarantee cashier's check, certified check, or bid bond on the **Cranbury Public Library** project in the amount of _____ Dollars in accordance with the conditions named in the foregoing Instruction to Bidders.

The undersigned Bidder hereby agrees that if this proposal shall be accepted by the Owner and the undersigned shall fail to execute and deliver the Contract and Contract Bond in accordance with the terms of this proposal and with the requirements of the foregoing Instruction to Bidders, then the undersigned shall be deemed to have abandoned the contract, and thereupon the proposal and its acceptance shall be null and void and the bid security shall be payable thereunder to the Owner as liquidated damages, otherwise and said guarantee, or the amount thereof, shall be returned to the undersigned.

Signature of Bidder

Date

Consent of Surety

_____ (hereinafter called Surety), organized and existing
(Name of Insurance Company)
under the laws of the State of _____ and duly authorized and qualified to transact business
in the State of New Jersey, in consideration of the sum of one Dollar (\$1.00), lawful money of the United States of
America, to it in hand paid, receipt whereof is hereby acknowledged, and in consideration of other valuable
consideration, hereby certifies and agrees that if the contract for which the attached Proposal is made be awarded to
_____ (hereinafter called Contractor) for the performance of certain work or the supplying of
certain materials, or both, as more particularly set forth in said Proposal and described for purposes of this
instrument as a Proposal to the **Cranbury Public Library**, and if Contractor shall enter into the contract, Surety
will become bound as surety for its faithful performance and will provide the Contractor with a bond in the full
amount of the contract price.

(Name of Insurance Company)

(Address)

Signature of Attorney-In-Fact
for Insurance Company

Note: Proof of authority of officers of surety company to execute this document must be submitted.

Bidder's Qualification Form

All questions must be answered and the data given must be clear and comprehensive. This statement must be notarized:

1. Name of Bidder: _____
2. Business Address: _____
3. Business Registration Certificate Number _____
4. If a corporation, answer the following:
 - a. Date of Incorporation: _____ Federal ID #: _____
 - b. State of Incorporation: _____
 - c. President's name(s): _____
 - d. Vice President's name(s): _____
5. If individual or partnership answer the following:
 - a. Date of Organization: _____
 - b. Type of Organization: _____
 - c. Name and address of all partners: _____

6. List number of years of experience Bidder has with work of similar nature to this project being bid:

7. Have you ever refused to sign a contract at your original bid: _____
If yes, Why: _____

8. Have you ever defaulted on a contract: _____
If yes, Why: _____

9. Are there any liens, of any character, filed against your company at this time? _____
If yes, specify the nature and amount of lien: _____

10. Contracts now in hand: _____ Gross Amount: _____
11. Give bank references: _____

12. Status of Contracts on Hand: Give full information about all your current contracts, whether private or government contracts, whether prime or sub-contracts, whether in progress or awarded but not yet begun, or where you are low bidder pending formal award of contract. Submit additional copies as necessary to describe all current contracts.

Contract #1

Owner: _____ Contact/Phone: _____
Project Location: _____
Description: _____
Contract Amount: _____
Amount Completed and Billed: _____
Estimated Date of Completion: _____

Contract #2

Owner: _____ Contact/Phone: _____
Project Location: _____
Description: _____
Contract Amount: _____
Amount Completed and Billed: _____
Estimated Date of Completion: _____

Contract #3

Owner: _____ Contact/Phone: _____
Project Location: _____
Description: _____
Contract Amount: _____
Amount Completed and Billed: _____
Estimated Date of Completion: _____

Contract #4

Owner: _____ Contact/Phone: _____
Project Location: _____
Description: _____
Contract Amount: _____
Amount Completed and Billed: _____
Estimated Date of Completion: _____

13. Please list at least four projects completed in the past three years. Include all information requested below, filling in all blanks. **PROJECTS LISTED SHOULD BE OF A SIMILAR NATURE TO THIS PROJECT BEING BID ON.**

Project #1

Owner: _____

Street: _____ City: _____ State: _____

Contact: _____ Position: _____ Phone: _____

Project Name: _____ Type: _____

Contract Amount: _____ Date Completed: _____

Street: _____ City: _____ State: _____

Architect / Engineer: _____

Street: _____ City: _____ State: _____

Contact: _____ Position: _____ Phone: _____

Project #2

Owner: _____

Street: _____ City: _____ State: _____

Contact: _____ Position: _____ Phone: _____

Project Name: _____ Type: _____

Contract Amount: _____ Date Completed: _____

Street: _____ City: _____ State: _____

Architect / Engineer: _____

Street: _____ City: _____ State: _____

Contact: _____ Position: _____ Phone: _____

Project #3

Owner: _____

Street: _____ City: _____ State: _____

Contact: _____ Position: _____ Phone: _____

Project Name: _____ Type: _____

Contract Amount: _____ Date Completed: _____

Street: _____ City: _____ State: _____

Architect / Engineer: _____

Street: _____ City: _____ State: _____

Contact: _____ Position: _____ Phone: _____

Project #4

Owner: _____

Street: _____ City: _____ State: _____

Contact: _____ Position: _____ Phone: _____

Project Name: _____ Type: _____

Contract Amount: _____ Date Completed: _____

Street: _____ City: _____ State: _____

Architect / Engineer: _____

Street: _____ City: _____ State: _____

Contact: _____ Position: _____ Phone: _____

- 14. The undersigned hereby authorizes and requests any person to furnish any information requested by the Owner in verification of the recitals comprising this Statement of Bidder's Qualifications.

(Name of Bidder)

By: _____

Title: _____

Subscribed and sworn to before me

this _____ day of _____ 20____

Notary Public

My commission expires _____

Plan and Equipment Questionnaire

Submitted to **Cranbury Public Library**, Middlesex County, New Jersey

By (Company Name) _____

Principal Office Address _____

The signatory of this questionnaire guarantees the truth and accuracy of all statements and of all answers to interrogatories hereinafter made.

1. In what manner have you inspected the proposed Work? Explain in detail.

2. Explain your plan or layout for performing the proposed Work.

3. The Work, if awarded to you, will have the personal supervision of whom? _____

4. What percent of the proposed work do you intend to do with subcontractors? _____%

5. What equipment do you own that is available for and intended to be used on the proposed project? _____

Table #1

Quantity	Item	Description	Condition	Yrs. of Service	Present Location
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

6. What equipment do you intend to purchase or lease for use on the proposed Work, should the contract be awarded to you?

Table# 2

Quantity	Item	Description	Approximate Cost to	
			Purchase	Lease
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

7. Have you received firm offers of all materials utilized within prices used in preparing your proposal? Do not give name of dealers or manufacturers.

_____ Yes _____ No

The Undersigned hereby declare(s) that the items of equipment in Table #1 are Owned by

_____, and are available for and intended to be used on the Project if awarded the Contract, and that (he) (she) (they) propose(s) to purchase or lease for the Project the additional items of equipment stated in Table #2.

If awarded the Contract, the Undersigned will furnish certificates from the owners of leased equipment to affect that, in case of default of contract, as set forth in the General Conditions the Governing Body has the right to take over the leased equipment for use in completing the Work.

Dated at _____ this _____ day of _____, 20_____.

(Name of Organization)

By _____

State of _____

County of _____

_____, Being duly sworn, deposed and says that he

is _____ of the above _____
(Title) (Name of Organization)

and that the answers to the foregoing questions and all statements therein contained are true and correct.

Subscribed and Sworn to before me

this _____ day of _____, 20_____

Notary Public

My Commission Expires _____

Subcontractor List Certificate

This certificate shall set forth the Scope of Work for which these subcontractors have submitted a price quote and which the Contractor has agreed to award to each subcontractor, should the Contractor be awarded the contract. This certificate must be submitted as part of the required quote forms. (N.J.S.A. 40A:11-16) Make additional copies as needed.

Subcontractor #1 (Plumbing and gas fitting and all kindred work)

Name: _____ License #: _____

Address: _____

Contact: _____ Phone: _____

Business Registration Certificate Number _____

Subcontractor #2 (Steam power plants, steam and hot water heating and ventilating apparatus and all kindred work)

Name: _____ License #: _____

Address: _____

Contact: _____ Phone: _____

Business Registration Certificate Number _____

Subcontractor #3 (Electrical Work)

Name: _____ License #: _____

Address: _____

Contact: _____ Phone: _____

Business Registration Certificate Number _____

Subcontractor #4 (Structural steel and ornamental iron work)

Name: _____ License #: _____

Address: _____

Contact: _____ Phone: _____

Business Registration Certificate Number _____

Subcontractor #5 (All other subcontractors)

Name: _____ License #: _____

Address: _____

Contact: _____ Phone: _____

Business Registration Certificate Number _____

Subcontractor #6 (All other subcontractors)

Name: _____ License #: _____

Address: _____

Contact: _____ Phone: _____

Business Registration Certificate Number _____

Subcontractor #7 (All other subcontractors)

Name: _____ License #: _____

Address: _____

Contact: _____ Phone: _____

Business Registration Certificate Number _____

Subcontractor #8 (All other subcontractors)

Name: _____ License #: _____

Address: _____

Contact: _____ Phone: _____

Business Registration Certificate Number _____

Signed _____

(Bidder's Signature)

(Date)

Subscribed and sworn to before me

this _____ day of _____ 20____

Notary Public

My commission expires _____

Non-collusion Affidavit

State of New Jersey

County of _____

ss:

I, _____ residing in _____
(name of affiant) (name of municipality)
in the County of _____ and State of _____ of full age,
being duly sworn according to law on my oath depose and say that:

I am _____ of the firm of _____
(title or position) (name of firm)

_____ the bidder making this Proposal for the bid

entitled _____, and that I executed the said proposal with
(title of bid proposal)

full authority to do so that said bidder has not, directly or indirectly entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free, competitive bidding in connection with the above named project; and that all statements contained in said proposal and in this affidavit are true and correct, and made with full knowledge that the _____

_____ relies upon the truth of the statements contained in said Proposal
(name of contracting unit)

and in the statements contained in this affidavit in awarding the contract for the said project.

I further warrant that no person or selling agency has been employed or retained to solicit or secure such contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, except bona fide employees or bona fide established commercial or selling agencies maintained by _____.

Subscribed and sworn to

before me this day

Signature

_____, 2 _____

(Type or print name of affiant under signature)

Notary public of

My Commission expires _____

(Seal)

STATEMENT OF OWNERSHIP DISCLOSURE

N.J.S.A. 52:25-24.2 (P.L. 1977, c.33, as amended by P.L. 2016, c.43)

This statement shall be completed, certified to, and included with all bid and proposal submissions. Failure to submit the required information is cause for automatic rejection of the bid or proposal.

Name of Organization: _____

Organization Address: _____

Part I Check the box that represents the type of business organization:

- Sole Proprietorship (skip Parts II and III, execute certification in Part IV)
- Non-Profit Corporation (skip Parts II and III, execute certification in Part IV)
- For-Profit Corporation (any type) Limited Liability Company (LLC)
- Partnership Limited Partnership Limited Liability Partnership (LLP)
- Other (be specific): _____

Part II

The list below contains the names and addresses of all stockholders in the corporation who own 10 percent or more of its stock, of any class, or of all individual partners in the partnership who own a 10 percent or greater interest therein, or of all members in the limited liability company who own a 10 percent or greater interest therein, as the case may be. **(COMPLETE THE LIST BELOW IN THIS SECTION)**

OR

No one stockholder in the corporation owns 10 percent or more of its stock, of any class, or no individual partner in the partnership owns a 10 percent or greater interest therein, or no member in the limited liability company owns a 10 percent or greater interest therein, as the case may be. **(SKIP TO PART IV)**

(Please attach additional sheets if more space is needed):

Name of Individual or Business Entity	Home Address (for Individuals) or Business Address

Part III DISCLOSURE OF 10% OR GREATER OWNERSHIP IN THE STOCKHOLDERS, PARTNERS OR LLC MEMBERS LISTED IN PART II

If a bidder has a direct or indirect parent entity which is publicly traded, and any person holds a 10 percent or greater beneficial interest in the publicly traded parent entity as of the last annual federal Security and Exchange Commission (SEC) or foreign equivalent filing, ownership disclosure can be met by providing links to the website(s) containing the last annual filing(s) with the federal Securities and Exchange Commission (or foreign equivalent) that contain the name and address of each person holding a 10% or greater beneficial interest in the publicly traded parent entity, along with the relevant page numbers of the filing(s) that contain the information on each such person. **Attach additional sheets if more space is needed.**

Website (URL) containing the last annual SEC (or foreign equivalent) filing	Page #'s

Please list the names and addresses of each stockholder, partner or member owning a 10 percent or greater interest in any corresponding corporation, partnership and/or limited liability company (LLC) listed in Part II **other than for any publicly traded parent entities referenced above.** The disclosure shall be continued until names and addresses of every noncorporate stockholder, and individual partner, and member exceeding the 10 percent ownership criteria established pursuant to N.J.S.A. 52:25-24.2 has been listed. **Attach additional sheets if more space is needed.**

Stockholder/Partner/Member and Corresponding Entity Listed in Part II	Home Address (for Individuals) or Business Address

Part IV Certification

I, being duly sworn upon my oath, hereby represent that the foregoing information and any attachments thereto to the best of my knowledge are true and complete. I acknowledge: that I am authorized to execute this certification on behalf of the bidder/proposer; that the **Cranbury Public Library** is relying on the information contained herein and that I am under a continuing obligation from the date of this certification through the completion of any contracts with **Cranbury Public Library** to notify the **Cranbury Public Library** in writing of any changes to the information contained herein; that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I am subject to criminal prosecution under the law and that it will constitute a material breach of my agreement(s) with the, permitting **Cranbury Public Library** to declare any contract(s) resulting from this certification void and unenforceable.

Full Name (Print):		Title:	
Signature:		Date:	

**STATE OF NEW JERSEY -- DIVISION OF PURCHASE AND PROPERTY
DISCLOSURE OF INVESTMENT ACTIVITIES IN IRAN**

Quote Number: _____

Bidder/Offeror: _____

**PART 1: CERTIFICATION
BIDDERS MUST COMPLETE PART 1 BY CHECKING EITHER BOX.
FAILURE TO CHECK ONE OF THE BOXES WILL RENDER THE PROPOSAL NON-RESPONSIVE.**

Pursuant to Public Law 2012, c. 25, any person or entity that submits a bid or proposal or otherwise proposes to enter into or renew a contract must complete the certification below to attest, under penalty of perjury, that neither the person or entity, nor any of its parents, subsidiaries, or affiliates, is identified on the Department of Treasury's Chapter 25 list as a person or entity engaging in investment activities in Iran. The Chapter 25 list is found on the Division's website at <http://www.state.nj.us/treasury/purchase/pdf/Chapter25List.pdf>. Bidders must review this list prior to completing the below certification. **Failure to complete the certification will render a bidder's proposal non-responsive.** If the Director finds a person or entity to be in violation of law, s/he shall take action as may be appropriate and provided by law, rule or contract, including but not limited to, imposing sanctions, seeking compliance, recovering damages, declaring the party in default and seeking debarment or suspension of the party

PLEASE CHECK THE APPROPRIATE BOX:

I certify, pursuant to Public Law 2012, c. 25, that neither the bidder listed above nor any of the bidder's parents, subsidiaries, or affiliates is listed on the N.J. Department of the Treasury's list of entities determined to be engaged in prohibited activities in Iran pursuant to P.L. 2012, c. 25 ("Chapter 25 List"). I further certify that I am the person listed above, or I am an officer or representative of the entity listed above and am authorized to make this certification on its behalf. I will skip Part 2 and sign and complete the Certification below.

OR

I am unable to certify as above because the bidder and/or one or more of its parents, subsidiaries, or affiliates is listed on the Department's Chapter 25 list. I will provide a detailed, accurate and precise description of the activities in Part 2 below and sign and complete the Certification below. Failure to provide such will result in the proposal being rendered as non-responsive and appropriate penalties, fines and/or sanctions will be assessed as provided by law.

PART 2: PLEASE PROVIDE FURTHER INFORMATION RELATED TO INVESTMENT ACTIVITIES IN IRAN

You must provide a detailed, accurate and precise description of the activities of the bidding person/entity, or one of its parents, subsidiaries or affiliates, engaging in the investment activities in Iran outlined above by completing the boxes below.

EACH BOX WILL PROMPT YOU TO PROVIDE INFORMATION RELATIVE TO THE ABOVE QUESTIONS. PLEASE PROVIDE THOROUGH ANSWERS TO EACH QUESTION. IF YOU NEED TO MAKE ADDITIONAL ENTRIES, CLICK THE "ADD AN ADDITIONAL ACTIVITIES ENTRY" BUTTON.

Name _____	Relationship to Bidder/Offeror _____
Description of Activities _____ _____	
Duration of Engagement _____	Anticipated Cessation Date _____
Bidder/Offeror Contact Name _____	Contact Phone Number _____

ADD AN ADDITIONAL ACTIVITIES ENTRY

Certification: I, being duly sworn upon my oath, hereby represent and state that the foregoing information and any attachments thereto to the best of my knowledge are true and complete. I attest that I am authorized to execute this certification on behalf of the above-referenced person or entity. I acknowledge that the State of New Jersey is relying on the information contained herein and thereby acknowledge that I am under a continuing obligation from the date of this certification through the completion of any contracts with the State to notify the State in writing of any changes to the answers of information contained herein. I acknowledge that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I recognize that I am subject to criminal prosecution under the law and that it will also constitute a material breach of my agreement(s) with the State of New Jersey and that the State at its option may declare any contract(s) resulting from this certification void and unenforceable.

Full Name (Print): _____ Signature: _____
Title: _____ Date: _____

**CERTIFICATION OF NON-DEBARMENT
FOR FEDERAL GOVERNMENT CONTRACTS**

N.J.S.A. 52:32-44.1 (P.L. 2019, c.406)

This certification shall be completed, certified to, and submitted to the contracting unit prior to contract award, except for emergency contracts where submission is required prior to payment.

PART I: VENDOR INFORMATION	
Individual or Organization Name	
Address of Individual or Organization	
DUNS Code (if applicable)	
CAGE Code (if applicable)	
Check the box that represents the type of business organization:	

- Sole Proprietorship (skip Parts III and IV)
 Non-Profit Corporation (skip Parts III and IV)
 For-Profit Corporation (any type)
 Limited Liability Company (LLC)
 Partnership
 Limited Partnership
 Limited Liability Partnership (LLP)
 Other (be specific): _____

PART II – CERTIFICATION OF NON-DEBARMENT: Individual or Organization			
<p>I hereby certify that the individual or organization listed above in Part I is not debarred by the federal government from contracting with a federal agency. I further acknowledge: that I am authorized to execute this certification on behalf of the above-named organization; that the Cranbury Public Library is relying on the information contained herein and that I am under a continuing obligation from the date of this certification through the date of contract award by Library to notify the Library in writing of any changes to the information contained herein; that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I am subject to criminal prosecution under the law and that it will constitute a material breach of my agreement(s) with the Library, permitting the Library to declare any contract(s) resulting from this certification void and unenforceable.</p>			
Full Name (Print):		Title:	
Signature:		Date:	

PART III – CERTIFICATION OF NON-DEBARMENT: Individual or Entity Owning Greater than 50 Percent of Organization

Section A (Check the Box that applies)

<input type="checkbox"/>	Below is the name and address of the stockholder in the corporation who owns more than 50 percent of its voting stock, or of the partner in the partnership who owns more than 50 percent interest therein, or of the member of the limited liability company owning more than 50 percent interest therein, as the case may be.
Name of Individual or Organization	
Home Address (for Individual) or Business Address	
OR	
<input type="checkbox"/>	No one stockholder in the corporation owns more than 50 percent of its voting stock, or no partner in the partnership owns more than 50 percent interest therein, or no member in the limited liability company owns more than 50 percent interest therein, as the case may be.

Section B (Skip if no Business entity is listed in Section A above)

<input type="checkbox"/>	Below is the name and address of the stockholder in the corporation who owns more than 50 percent of the voting stock of the organization’s parent entity, or of the partner in the partnership who owns more than 50 percent interest in the organization’s parent entity, or of the member of the limited liability company owning more than 50 percent interest in organization’s parent entity, as the case may be.
Stockholder/Partner/Member Owning Greater Than 50 Percent of Parent Entity	
Home Address (for Individual) or Business Address	
OR	
<input type="checkbox"/>	No one stockholder in the parent entity corporation owns more than 50 percent of its voting stock, no partner in the parent entity partnership owns more than 50 percent interest therein, or no member in the parent entity limited liability company owns more than 50 percent interest therein, as the case may be.

Section C – Part III Certification

I hereby certify that no individual or organization that is debarred by the federal government from contracting with a federal agency owns greater than 50 percent of the **Organization listed above in Part I** or, if applicable, owns greater than 50 percent of a parent entity of **<name of organization>**. I further acknowledge: that I am authorized to execute this certification on behalf of the above-named organization; that the **<name of contracting unit>** is relying on the information contained herein and that I am under a continuing obligation from the date of this certification through the date of contract award **<type of contracting unit>** to notify the **<type of contracting unit>** in writing of any changes to the information contained herein; that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I am subject to criminal prosecution under the law and that it will constitute a material breach of my agreement(s) with the **<type of contracting unit>**, permitting the **<type of contracting unit>** to declare any contract(s) resulting from this certification void and unenforceable.

Full Name (Print):		Title:	
Signature:		Date:	

Part IV – CERTIFICATION OF NON-DEBARMENT: Contractor – Controlled Entities

Section A



Below is the name and address of the corporation(s) in which the **Organization listed in Part I** owns more than 50 percent of voting stock, or of the partnership(s) in which the **Organization listed in Part I** owns more than 50 percent interest therein, or of the limited liability company or companies in which the **Organization listed above in Part I** owns more than 50 percent interest therein, as the case may be.

Name of Business Entity	Business Address

Add additional sheets if necessary

OR



The **Organization listed above in Part I** does not own greater than 50 percent of the voting stock in any corporation and does not own greater than 50 percent interest in any partnership or any limited liability company.

Section B (skip if no business entities are listed in Section A of Part IV)			
<input type="checkbox"/>	Below are the names and addresses of any entities in which an entity listed in Part III A owns greater than 50 percent of the voting stock (corporation) or owns greater than 50 percent interest (partnership or limited liability company).		
Name of Business Entity Controlled by Entity Listed in Section A of Part IV		Business Address	
Add additional Sheets if necessary			
OR			
<input type="checkbox"/>	No entity listed in Part III A owns greater than 50 percent of the voting stock in any corporation or owns greater than 50 percent interest in any partnership or limited liability company.		
Section C – Part IV Certification			
<p>I hereby certify that the Organization listed above in Part I does not own greater than 50 percent of any entity that that is debarred by the federal government from contracting with a federal agency and, if applicable, does not own greater than 50 percent of any entity that in turns owns greater than 50 percent of any entity debarred by the federal government from contracting with a federal agency. I further acknowledge: that I am authorized to execute this certification on behalf of the above-named organization; that the Cranbury Public Library is relying on the information contained herein and that I am under a continuing obligation from the date of this certification through the date of contract award by Library to notify the Library in writing of any changes to the information contained herein; that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I am subject to criminal prosecution under the law and that it will constitute a material breach of my agreement(s) with the Library, permitting the Library to declare any contract(s) resulting from this certification void and unenforceable.</p>			
Full Name (Print):		Title:	
Signature:		Date:	

Certification By Bidder Regarding Equal Employment Opportunity

INSTRUCTIONS

The Bidder represents that he () has, () has not, participated in a previous Contract or subcontract subject to the Equal Opportunity clause prescribed by Executive Orders 10925, 11114, or 121256 or the Secretary of Labor; that he () has, () has not, filed all required compliance reports, signed by proposed subcontractors, will be obtained prior to subcontract awards. (The above representation need not be submitted in connection with Contracts or Subcontractors which are exempt from the clause.)

Certification of Nonsegregated Facilities. By signing this bid, the bidder certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. He certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The bidder agrees that a breach of this certification is a violation of the Equal Opportunity clause in this Contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin, because of habit, local custom or otherwise. He further agrees that (except where he has obtained identical certifications from proposed subcontractors for specified time periods) he will obtain identical certifications from proposed subcontracts prior to the award of subcontract exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause; that he will forward a notice to his proposed subcontractors as provided in the Instructions to Bidders.

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

CERTIFICATION BY BIDDER:

Bidder's Name: _____

Address and Zip Code: _____

1. Bidder has participated in a previous contract or subcontract subject to the Equal Opportunity clause:

Yes_____ No_____ (If answer is yes, identify the most recent contract)

2. Compliance reports were required to be filed in connection with such contract or subcontract.

Yes_____ No_____ (If answer is yes, identify the most recent contract)

3. Bidder has filed all compliance reports due under applicable instruction, including AA-302, Equal Employment Opportunity Employee Information Report

Yes_____ No_____ (If answer is yes, identify the most recent contract)

4. If answer to Item 3 is "No" please explain in detail on reverse side of this certification.

Certification - The information above is true and complete to the best of my knowledge and belief.

Name and Title of Signer (Please Type)

Signature

Date

Affidavit for Affirmative Action Plan

STATE OF _____)

SS

COUNTY OF _____)

_____ being first duly sworn
(Individual's Name)

deposes and says:

THAT he is _____ the
(Partner or Officer of the Firm of, Etc.)

party making a certain proposal or bid dated _____20____ for work in connection with the
construction of _____
(Indicate Job Name)

at Project No. _____, located at
_____, New Jersey that such proposal or bid is submitted with full knowledge and
understanding of the Affirmative Action Plan (AAP) requirements contained herein; that in submitting such
proposal or bid the bidder acknowledges that he must and will fulfill these requirements and that all statements in
said proposal or bid are true.

SIGNATURE OF:

Bidder, if the bidder is an individual;
Officer, if the bidder is a Corporation,
Partner, if the bidder is a Partnership

(Signature of Contractor)

Subscribed and Sworn to before me

this _____ day of _____, 20____

Notary Public

My Commission Expires _____

New Jersey Business Registration Requirements

Proof of New Jersey Business Registration must be provided prior to bid award for contractors and all subcontractors. Failure to submit said registration is mandatory cause for the proposal not to be awarded. Attach proof of said registration, if available at this time.

This is to certify that the firm of _____ is registered with the State of New Jersey, Division of Taxation, and will comply with the requirements as noted above.

I understand that this registration is mandatory for public works contracts and proof of said registration is to be forwarded to the **Cranbury Public Library** prior to Proposal award.

Signature: _____

Title: _____

Contractor: _____

Business Registration Certificate Number: _____

Public Works Contractor Registration Act Statement

This is to certify that the firm of _____ is registered with the Department of Labor and complies with the requirements of N.J.S.A. 34:11 – 56.48 et seq.

I understand that this registration is mandatory for public works contracts and that all named contractors must be registered with the Department of Labor's Division of Wage and Hour Compliance at the time proposals are received. Proof of said registration is to be submitted prior to Proposal award.

Signature: _____

Title: _____

Bidder: _____

BID DOCUMENT SUBMISSION CHECKLIST

Cranbury Public Library
(Name of Local Contracting Unit)

Cranbury Public Library
(Name of Construction/Public Works Project)

Project # 1404
(Project or Bid Number)

Failure to submit any of the following documents may be a cause for bid to be rejected.		Initial Each Item Submitted With Bid (Bidder's initials)
BF	Bid Form	
ARA	If applicable, bidder's acknowledgement of receipt of any notice(s) or revision(s) or addenda to an advertisement, specifications or bid document(s)	
BSF	A bid guarantee as required by N.J.S.A. 40A:11-21	
COS	A certificate from a surety company, pursuant to N.J.S.A. 40A:11-22	
BQF	Bidders Qualification Form	
PEQ	Certification of Bidder showing that Bidder owns, leases or controls any necessary equipment.	
SL	A listing of subcontractors as required by N.J.S.A. 40A:11-16	
NA	Submission of a Non-Collusion Affidavit (this form must be Notarized)	
SOD	A Statement of corporate ownership, (Stockholder Disclosure), pursuant to N.J.S.A. 52:25-24.2	
DIAI	Disclosure of Investment Activities in Iran	
CND	Certification of Non-Debarment for Federal Government Contracts	
CBB	Certification By Bidder	
AAP	Affidavit for Affirmative Action Plan	
BRR	NJ Business Registration Certificates for Contractor & all Subcontractors	
PWCR	Public Works Contractor Registration Certificates for Contractor & all Subcontractors	
BDSC	Bid Document Submission Checklist	

Signature: The undersigned hereby acknowledges and has submitted the above requirements.

Name of Bidder: _____

By Authorized Representative:

Signature: _____

Printed Name and Title: _____

Date: _____

Sample Agreement



AIA® Document A101™ – 2017

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the day of in the year
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

and the Contractor:
(Name, legal status, address and other information)

for the following Project:
(Name, location and detailed description)

The Architect:
(Name, legal status, address and other information)

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101™–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201™–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

Init.

TABLE OF ARTICLES

- 1 THE CONTRACT DOCUMENTS**
- 2 THE WORK OF THIS CONTRACT**
- 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION**
- 4 CONTRACT SUM**
- 5 PAYMENTS**
- 6 DISPUTE RESOLUTION**
- 7 TERMINATION OR SUSPENSION**
- 8 MISCELLANEOUS PROVISIONS**
- 9 ENUMERATION OF CONTRACT DOCUMENTS**

EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:

(Check one of the following boxes.)

- The date of this Agreement.
- A date set forth in a notice to proceed issued by the Owner.
- Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:

Init.

(Check one of the following boxes and complete the necessary information.)

[] Not later than () calendar days from the date of commencement of the Work.

[] By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date
-----------------	-----------------------------

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor’s performance of the Contract. The Contract Sum shall be (\$), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price
------	-------

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement. (Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance
------	-------	---------------------------

§ 4.3 Allowances, if any, included in the Contract Sum: (Identify each allowance.)

Item	Price
------	-------

§ 4.4 Unit prices, if any: (Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit (\$0.00)
------	-----------------------	-------------------------

§ 4.5 Liquidated damages, if any: (Insert terms and conditions for liquidated damages, if any.)

§ 4.6 Other: (Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the day of the month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than () days after the Architect receives the Application for Payment.

(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™-2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

- .1 That portion of the Contract Sum properly allocable to completed Work;
- .2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- .3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

- .1 The aggregate of any amounts previously paid by the Owner;
- .2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201-2017;
- .3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- .4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201-2017; and
- .5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:

(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner’s prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

- .1 the Contractor has fully performed the Contract except for the Contractor’s responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner’s final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect’s final Certificate for Payment, or as follows:

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

(Insert rate of interest agreed upon, if any.)

%

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:

(Check the appropriate box.)

- Arbitration pursuant to Section 15.4 of AIA Document A201–2017
- Litigation in a court of competent jurisdiction
- Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner’s convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:

(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner’s convenience.)

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner’s representative:

(Name, address, email address, and other information)

§ 8.3 The Contractor’s representative:

(Name, address, email address, and other information)

Init.

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:

(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

- .1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor
- .2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds
- .3 AIA Document A201™–2017, General Conditions of the Contract for Construction
- .4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)

.5 Drawings

Number	Title	Date
--------	-------	------

.6 Specifications

Section	Title	Date	Pages
---------	-------	------	-------

.7 Addenda, if any:

Number	Date	Pages
--------	------	-------

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:

(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

Init.

AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

The Sustainability Plan:

Title	Date	Pages
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Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
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.9 Other documents, if any, listed below:

(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

This Agreement entered into as of the day and year first written above.

OWNER (Signature)

CONTRACTOR (Signature)

(Printed name and title)

(Printed name and title)

Init.

Sample

AIA[®] Document A201[™] – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

THE OWNER:
(Name, legal status and address)

THE ARCHITECT:
(Name, legal status and address)

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- 3 CONTRACTOR
- 4 ARCHITECT
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- 10 PROTECTION OF PERSONS AND PROPERTY
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- 12 UNCOVERING AND CORRECTION OF WORK
- 13 MISCELLANEOUS PROVISIONS
- 14 TERMINATION OR SUSPENSION OF THE CONTRACT
- 15 CLAIMS AND DISPUTES

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503[™], Guide for Supplementary Conditions.

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent

consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements,

assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

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§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

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§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the

Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

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§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the

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Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations

and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor,

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prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work,

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promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

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- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will

affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and

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unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

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§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 **Notice of Cancellation or Expiration of Contractor's Required Insurance.** Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 **Failure to Purchase Required Property Insurance.** If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 **Notice of Cancellation or Expiration of Owner's Required Property Insurance.** Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§ 11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to

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the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

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ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or Suppliers;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance,

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the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the

Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

DRAWING LIST

<u>DRAWING #</u>	<u>TITLE</u>
G.001	LOCATION MAP, SYMBOLS, ABBREVIATIONS & DRAWING LIST
G.002	CODE REVIEW & EGRESS PLAN

CIVIL

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102113 Phenolic-Core Toilet Compartments
102239 Folding Panel Partitions
102800 Toilet Accessories

DIVISION 11 – EQUIPMENT (Not Used)

DIVISION 12 – FURNISHINGS (Not Used)

DIVISION 13 - SPECIAL CONSTRUCTION (Not Used)

DIVISION 14 - CONVEYING SYSTEMS (Not Used)

DIVISION 15 – MECHANICAL

15400 Plumbing
15600 HVAC

DIVISION 16 – ELECTRICAL

16000 Electrical

DIVISION 26 – ELECTRICAL (SITE)

26 56 00 Exterior Lighting

DIVISION 31 – EARTHWORK (SITE)

31 05 13 Soils for Earthwork
31 05 16 Aggregates for Earthwork
31 10 00 Site Clearing
31 22 13 Rough Grading
31 23 16 Excavation
31 23 17 Trenching
31 23 23 Fill
31 25 13 Erosion Controls

DIVISION 32 – EXTERIOR IMPROVEMENTS (SITE)

32 05 13 Soils for Exterior Improvements
32 05 16 Aggregates for Exterior Improvements
32 11 23 Aggregate Base Courses
32 12 16 Asphalt Paving
32 13 13 Concrete Paving
32 14 13 Precast Concrete Unit Paving
32 17 23 Pavement Markings
32 91 13 Soil Preparation
32 91 19 Landscape Grading
32 92 19 Seeding
32 93 00 Plants

DIVISION 33 – UTILITIES (SITE)

33 05 13 Manholes and Structures
33 05 16 Utility Structures
33 11 16 Site Water Utility Distribution Piping
33 31 00 Sanitary Utility Sewerage Piping
33 41 00 Storm Utility Drainage Piping

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Access to site.
 - 4. Coordination with occupants.
 - 5. Work restrictions.
 - 6. Specification and drawing conventions.
- B. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

- A. Project Identification: **Cranbury Public Library**
 - 1. Project Location: 30 Park Place West, Cranbury, NJ.
- B. Architect: Arcari + Iovino Architects, PC.
 - 1 Katherine Street
 - Little Ferry, NJ 07643

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 - 1. Construct a new 11,600 sf, 1-story library and all associated site work as described in the plans and specifications.
- B. Type of Contract:
 - 1. Project will be constructed under a single prime contract.

1.5 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

1.6 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000



Report of Subsurface Exploration and Foundation Evaluation

PROPOSED NEW LIBRARY

Block 23, Lot 14.03
Township of Cranbury, Middlesex County, New Jersey

July 22, 2016

Prepared For

Ms. Marilyn Mullen, Treasurer
Cranbury Public Library Foundation
23 North Main Street
Cranbury, NJ 08512

Prepared By

Maser Consulting P.A.
Corporate Headquarters
331 Newman Springs Road, Suite 203
Red Bank, NJ 07701
732.383.1950

A handwritten signature in black ink that reads 'Michael Carnivale III'.

Michael Carnivale, III, P.E., Senior Project Manager
Professional Engineer
New Jersey License No. 45357

MC Project No. 15001826A





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FIGURES

Geotechnical Exploration PlanDrawing No. 1

APPENDICES

APPENDIX ATest Boring Logs



1. INTRODUCTION

This report presents the results of the geotechnical exploration undertaken to provide geotechnical design criteria and foundation support recommendations for a proposed development consisting of new, approximately 11,000 square foot (sf), one-story library with an associated parking lot, located on Block 23, Lot 14.03, near the existing Municipal Building, in the Township of Cranbury, Middlesex County, New Jersey.

The purpose of this exploration was to evaluate the existing subsurface conditions at the project site and to provide recommendations for foundation support and site development for the proposed structure. The recommendations include the anticipated type of foundation to be used in the design, seismic site class, and a discussion of earthwork operations and related procedures.

2. SITE AND PROJECT DESCRIPTION

The project site is located on an existing open field located immediately behind the Cranbury Township Municipal Building, 23-A North Main Street, in the Township of Cranbury, Middlesex County, New Jersey. The site is known as Block 23, Lot 14.03 on the Cranbury Township Tax Maps. The project site is bounded on the north by an asphalt driveway which ties into the intersection of Prospect Street and Bunker Hill Drive, to the south by a parking lot which services the Municipal Building, to the west by a ballfield, and to the east by Park Place Court and tennis courts. The site can be access through by Park Place West, which comes to a dead end right at property. Existing grades range from approximate Elevation 100 feet in the north and gently slope to approximate Elevation 97 in the south. Elevations were obtained from Google Earth imagery and are considered to be approximate. The proposed development consists of an approximately 11,000 square foot one-story library with associated 20 space parking lot, along with typical appurtenant site improvements.

3. SCOPE OF SERVICES

The purpose of this geotechnical exploration was to evaluate the subsurface conditions encountered at the test boring locations, and to subsequently provide geotechnical consultation regarding site development and foundation support recommendations. We were authorized to perform the following scope of services:

- a) Retain a drilling contractor to perform test borings to explore the subsurface soil and groundwater conditions (refer to the Geotechnical Exploration Plan, Drawing 1);
- b) Provide full-time technical observation of the work of the drilling contractor;
- c) Obtain representative soil samples encountered within the test borings;



- d) Evaluate and prepare test boring logs showing the types of soils encountered, as well as depth to groundwater; and,
- e) Prepare this Subsurface Exploration and Foundation Evaluation report, presenting the results of our subsurface investigation, engineering evaluation, and subsequent recommendations for foundation support and site earthwork.

4. SUBSURFACE EXPLORATION PROGRAM

The subsurface conditions at the site were explored on June 27, 2016 through the advancement of six test borings, labeled TB-1 through TB-6. The test borings were field-located by Maser Consulting using the proposed development plans and existing site features available at the time of our field exploration program. The test boring locations are shown on Geotechnical Exploration Plan, Drawing No. 1.

The test borings were advanced to termination depths ranging from approximately 8 to 27 feet below ground surface (bgs) by Granese Drilling, Inc., of Shrewsbury, New Jersey, using standard hollow-stem auger drilling techniques. Split spoon sampling was performed in accordance with ASTM D1586 (Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils). The number of blows required to drive the split spoon every 6 inches into the soil was recorded and is shown on the test boring log. The sum of blows for the interval from 6 inches to 18 inches is the N-value. The N-value indicates the soil resistance encountered within each sampling interval.

The test borings were performed under the full-time technical observation of Maser Consulting. Representative soil samples from the test borings were collected and visually identified in accordance with the Burmister Soil Classification System. Representative soil samples of strata encountered were collected and transported to Maser Consulting's Red Bank laboratory facilities for further evaluation and analyses. Details pertaining to the subsurface conditions encountered are presented on the Test Boring Logs in Appendix A.

5. SUBSURFACE CONDITIONS

5.1 Subsurface Description

The generalized subsurface conditions at this site may be described as follows, in order of depth:

- **Surface Cover** – Test borings disclosed a topsoil layer approximately 8 to 10 inches thick.
- **Stratum A –Brown and Orange Clayey Silt with varying amounts of Sand and Gravel:** Underlying the surface cover is a stratum consisting of brown and orange clayey silt with some coarse to fine sand and little medium to fine gravel. The N-values for this stratum range from 7 to 24

blows per foot (bpf) with values predominately in the 10 to 20 bpf range. This layer extended to depths ranging from approximately 2 to 6 feet ground surface. The material was generally noted to have a medium stiff state of consistency.

- **Stratum B – Yellow, Brown, Orange and Gray Sand with varying amounts of Silt, Clay and Gravel:** Underlying Stratum A is a stratum of natural soils consisting of yellow, brown, orange and gray coarse to fine sand, with varying amounts of silt and clay (trace to little) and medium to fine gravel (trace to little). The N-values for this stratum range from 11 to 71 blows per foot (bpf) with values predominately in the 15 to 25 bpf range. This layer extended to a depth of approximately 25 feet below ground surface in test borings TB-1, TB-2, TB-3 and TB-5, and to the termination depth of approximately 22 feet below existing grade in test boring TB-6. The material was generally noted to have a medium dense to very dense state of relative density.

- **Stratum C – Gray Silty Clay with varying amounts of Sand and Gravel:** Underlying Stratum B in test borings TB-1, TB-2, TB-3 and TB-5, is a layer of dark gray silty clay, with little medium to fine sand and trace amounts of fine gravel. This layer extended to the termination depth of approximately 27 feet below ground surface in the test borings noted. The N-values for this stratum range from 14 to 23 bpf. The material was generally noted to have a medium stiff state of consistency.

5.2 Groundwater Conditions

At the time of this subsurface exploration, groundwater was encountered at depths ranging from approximately 20 to 21.5 feet below existing grade within each of the test borings advanced as part of this exploration, with the exception of test boring TB-4, which was terminated at a depth of approximately 8 feet below existing grade.

Soil moisture and groundwater conditions should be expected to fluctuate with season, precipitation amounts, and other on-site and off-site factors including site utilization.



6. DISCUSSION AND RECOMMENDATIONS

The test borings indicated that the site is favorable for use of shallow foundation and slab on grade construction.

6.1 Site Preparation

The purpose of these site preparation procedures is to provide stable and uniform bearing conditions for the proposed building foundations and slab-on-grade. The following procedures should be performed under the technical supervision of the Geotechnical Engineer.

- Install soil erosion and sedimentation control devices, as well as temporary stormwater management facilities, as specified by Site/Civil Engineer.
- Maintain positive drainage conditions throughout construction, avoiding unnecessary ponding of stormwater in excavations or low areas of the site. Seal-roll exposed soil or subgrade surfaces prior to rain or snow events, and promptly remove any standing water immediately afterwards.
- Any existing underground or above-ground utility locations should be verified in the field and relocated or abandoned as necessary, prior to construction. If the option to abandon utilities in-place is chosen, we recommend that a lean cement grout (500 psi) be used to fill the utility lines.
- Remove and dispose of any vegetation at an appropriate off-site facility. Strip topsoil and stockpile onsite for later use. Alternatively, blend with other onsite soils for use as load-bearing fill in pavement and landscaping areas only.
- Following stripping of topsoil, and prior to the placement of load-bearing fills, proof-roll and compact the exposed subgrade heavily with a 10-ton vibratory compactor. The vibratory or static modes shall be used as directed by the on-site Geotechnical Engineer.
- Afterwards, the subgrade shall be proof-rolled with a loaded dump truck. Any remaining unstable zones should be remediated as directed by the onsite Geotechnical Engineer. Excavate any loose disturbed soils from within and a minimum distance of 5 feet beyond the proposed building footprint. Following the satisfactory subgrade preparation, replace the over-excavated soils in controlled, compacted lifts in accordance with the Load Bearing Fill section of this report.
- Place and compact load-bearing fill as needed to achieve the final subgrade elevations in accordance with the recommendations presented in Load Bearing Fill section of this report.



- In accordance with the Occupational Safety and Health Administration (OSHA) requirements, all excavations shall be properly sloped or otherwise structurally retained to provide stable and safe working conditions.

6.2 Shallow Foundations

The test borings indicated that the site subsurface conditions, after the above site preparation, will be suitable to the support of the structure on conventional shallow foundations. Conventional spread and strip footings may be designed for a maximum allowable soil bearing pressure of 3,000 pounds per square foot (psf). The bearing capacity may be increased by 30% for transit loadings. Footings may be supported on Stratum B or on compacted structural fill. Loose or soft soil is not considered suitable for foundation support and if encountered, should be excavated and replaced with structural fill compacted in-place. See Section 6.8, Load-Bearing Fill, of this report for further details.

The length of time that the exposed subgrade remains exposed to weather conditions should be kept to a minimum so as to not generate more unsuitable material removal. Onsite fill and soils exposed to weather conditions may soften, requiring removal and replacement prior to fill placement and foundation installation due to their sensitivity to moisture.

Wall and column footing widths should not be less than 1.5 and 3.0 feet, respectively. Footings should be founded at a minimum depth of 3 feet beneath finished grades for frost protection and for bearing considerations. Footing subgrades should be compacted using a “Jumping Jack” or other trench compactor upon completion of footing excavation prior to any form or reinforcing steel placement.

To confirm the design allowable soil bearing pressure, foundation bearing grades should be inspected by a qualified geotechnical engineer prior to the placement of forms and/or concrete. Should the footing subgrade be disturbed, the loosened soil should be compacted in-place. Backfilling against foundations and under floor slabs should be accomplished using structural fill placed and compacted under engineering observation. Any water that accumulates in the bottom of the excavation should be removed within 24 hours.

It is estimated that maximum post-construction footing settlement of the proposed building will be less than 1-inch and the differential settlement between adjacent columns will be less than ½ inch. These values are generally within tolerable limits for this type of structure.

6.3 Floor Slab

Concrete floor slabs can be uniformly supported on-grade and simply supported at the wall to allow unrestricted rotation or vertical movement of slab edges. Large floor areas should be provided with joints at frequent intervals, as directed by the Structural Engineer. A minimum of six inches of ¾-inch clean, crushed stone or a 12-inch thick layer (minimum) of well-graded sand and gravel, with no more than 12% non-plastic fines, is recommended below the slab to assure uniform curing conditions. A 6-mil PVC vapor retarder may be placed between the slab and base course, as directed by the Architect, to minimize moisture migration to the surface. Structural fill supporting the floor slab should be compacted to 95% of the maximum dry density determined in accordance with ASTM D1557 for the modified Proctor test.

6.4 Seismic Coefficients

Based upon the test boring data collected and our experience with the regional geology, the site has a Site Class Definition of “D” as determined in accordance with 2015 International Building Code (New Jersey Edition) requirements. This classification was determined by utilizing the Standard Penetration Test (SPT) blow count data through the upper 25 feet of the subsurface profile. Medium compact conditions were assumed throughout the remainder of the soil profile to a depth of 100 feet.

6.5 Lateral Earth Pressure Parameters for Below-Grade Walls

At the time of this report, basement walls are not currently proposed within a portion of the footprint of the new library. Should basement walls be required, these foundation walls should be designed using the soil parameters outlined in Table 1. Note that these parameters are ultimate values that do not incorporate a factor of safety. Appropriate, industry-standard factors of safety (typically 1.5 for permanent load cases and 1.3 for transient load cases), should be applied to the overall design of the wall systems.

Cantilevered retaining walls that are free to rotate should be designed for the active earth pressure condition. Walls that are braced or otherwise restricted from rotation (such as basement walls) should be designed for the at-rest earth pressure condition. Passive earth pressure is used to estimate the resisting force when a wall structure is being forced against the soil material.

Surcharge loading caused by additional surface loads on the retained soil should be added to the lateral pressure on the wall as a uniform stress equal to one-half the surcharge load. These loads may include vehicle or pedestrian traffic, temporary construction loads (stockpiles, material storage, equipment, etc.), floor slab or pavement loads, or other structures.



The earth pressure values are based on the assumption that no hydrostatic pressure from groundwater and/or surface infiltration will be applied to the walls. Where infiltration of surface water may occur behind a retaining wall, an appropriate drainage system shall be incorporated into the design.

Excavated predominantly granular soils are suitable for use as below-grade wall and retaining wall backfill. However, excavated soils that contain elevated quantities of silt and clay should generally not be used as backfill within the reinforced zone of retaining walls because these soils will be sensitive to moisture-related compaction problems, and their inherently poor drainage characteristics typically result in hydrostatic pressures exerted on the back-face of walls. The maximum particle size in wall backfill materials should be limited to 3 inches, and the backfill should be free of deleterious matter and debris.

TABLE NO. 1 LATERAL EARTH PRESSURE COEFFICIENTS					
<i>Subsurface Material</i>	<i>Total Unit Weight (pcf)</i>	<i>Internal Friction Angle</i>	<i>Wall Condition</i>	<i>Earth Pressure Coefficient</i>	<i>Equivalent Fluid Pressure (psf)</i>
Imported crushed stone/ Recycled Concrete Fill Material	135	34°	At Rest, K_o	0.44	60
			Active, K_a	0.28	39
			Passive, K_p	3.54	478
On-Site Coarse Grained Soils	120	32°	At Rest, K_o	0.31	37
			Active, K_a	0.33	40
			Passive, K_p	3.25	390

If the contractor is responsible for the design of temporary or permanent retaining structures, then the contract documents should clearly require that a competent registered engineer performs the design and that satisfactory earth support is solely the contractor’s responsibility. Furthermore, the contract documents should require the contractor to notify the engineer immediately if differing or unforeseen subsurface conditions are encountered during construction.

6.6 Site Drainage and Surface Water Control

Adequate temporary and permanent control of surface water runoff will be required in order to allow site access, grading and construction to proceed. Excavation, filling, subgrade and grade preparation should be performed in a manner and sequence that will provide drainage at all times as well as proper control of erosion. Surface water shall be pumped or drained to provide a suitable working platform. Any water accumulating in the open excavation shall be removed within 24 hours.



6.7 Dewatering

Groundwater was encountered at depths of 20 feet in several of the test borings during drilling operations. Excavations are not expected to extend into soils below the groundwater table. For excavations that require the removal of perched water or surface seepage, dewatering may be achieved by pumping from screened sumps.

6.8 Load-Bearing Fill

Load-bearing fill should consist of inorganic, readily compactable, predominantly well-graded granular soils with no more than 15% fines (material passing the No. 200 sieve). Maser Consulting recommends that fragments having a maximum dimension greater than three (3) inches be excluded from the fill. The moisture content of the fill materials should be controlled to within tolerable limits of the optimum by wetting, aeration, or blending to facilitate compaction. The field moisture-density relationship of materials being used will be as per ASTM D1557 and monitored by the Site Geotechnical Engineer during fill placement activities.

Load-bearing fill should be controlled fill placed in loose horizontal lifts with a maximum thickness of 12 inches. It is recommended that controlled fill within the construction area be compacted to at least 95% of the maximum dry density as determined by the Modified Proctor Test (ASTM D1557). In addition, we recommend that fills be stable without significant movement under construction traffic, as judged by the Site Geotechnical Engineer. Quality control testing of in-place fill densities should be conducted throughout the entire earthwork operation, load bearing fills, and areas where pavement and structures are proposed.

Imported granular fill material, if required, shall be well-graded and should conform to the following material gradation requirements. Alternate material submissions such as dense graded aggregate and recycled concrete aggregates may be made to the Site Geotechnical Engineer for approval:

**Recommended Gradation Envelope
IMPORTED GRANULAR FILL**

U.S. Standard Sieve Size	Percent Finer By Weight
2"	100
1"	80-100
3/8"	70-100
No. 10	50-100
No. 30	30-85
No. 60	15-65
No. 200	5-15



Table No. 2 below provides compaction requirements for the coarse-grained soils.

TABLE NO. 2 COMPACTION RECOMMENDATIONS	
<i>Type of Support</i>	<i>Load-Bearing Fill</i>
Beneath Building Foundations/Floor Slabs	95% of Modified Proctor (ASTM D 1557)
Behind Site Walls, Beneath Pavements	92% of Modified Proctor (ASTM D 1557)

6.9 Reuse of On-Site Soils

The granular soils of Stratum B are suitable for use as load-bearing fill for the construction of the proposed library.

6.10 Below-Grade Utilities

Proposed utility installation is not anticipated to be significantly impacted by groundwater concerns, provided they are installed at typical depths of 4 to 6 feet or less below final site grades. Utility excavations may encounter perched water conditions in the soils of Stratum A due to the presence of silts and clays, especially if construction starts during or after rainy seasons.

In addition, we offer the following recommendations specific to utility construction:

- Any excavated utility trenches beneath the proposed finished floor or pavement subgrades should be backfilled with compacted load-bearing fill in accordance with the recommendations outlined in the Load-Bearing Fill Section 6.8 of this report.
- Prior to installation, the bearing surface for utility structures (manholes, vaults, etc.) should be evaluated by the Geotechnical Engineer or technician. If loose or otherwise unstable material is present, this material should be removed and replaced with load-bearing fill. The utility structures should receive a bedding of at least 4 inches of dense-graded aggregate (DGA).

6.11 Existing Utilities

Any existing underground utilities should be located, and those utilities which are not reused should be removed and capped. The utility trenches that are in the influence zone of new construction are recommended to be backfilled with compacted structural fill or grout, as needed. Underground utilities, which are to be reused, should be evaluated by the structural engineer and utility backfill should be evaluated by the geotechnical engineer, to determine their suitability for

support of the planned construction. If any existing utilities are to be preserved, grading operations must be carefully performed so as to not disturb or damage the existing utility.

6.12 Over-Excavation / Stabilization

Construction during extended wet weather periods could create the need to over-excavate exposed soils if they become disturbed and cannot be recompacted due to elevated moisture content and/or weather conditions. The need for over-excavation should be confirmed through continuous observation and testing by the Geotechnical Engineer. Selective drying and recompaction of unsuitable subgrades may be accomplished by scarifying or windrowing surficial material during extended periods of dry and warm weather. Otherwise, use of imported material or chemical subgrade stabilization methods such as cement or fly ash could become necessary at additional cost. The need for subgrade over excavation and/or stabilization will be dependent, in part, on the subgrade protection effort exercised by the contractor. Similar subgrade stability problems may develop after completion of subgrade preparation due to weather and construction traffic effects, requiring stabilization prior to floor slab-on-grade and pavement construction.

7. CONSTRUCTION OBSERVATION

Regardless of the thoroughness of a geotechnical engineering exploration, there is always a possibility that conditions between the borings and test pits, and below the depths explored may be different from those encountered in the borings, that conditions are not as anticipated by the designers, or that the construction process has altered the subsurface conditions. Therefore, geotechnical engineering construction observation should be performed under the supervision of a Geotechnical Engineer from Maser Consulting who is familiar with the intent of the recommendations presented herein. This observation is recommended to evaluate whether the conditions anticipated in the design actually exist or whether the recommendations presented herein should be modified, where necessary. Maser Consulting should also provide observation and testing of compacted structural fill and backfill. Maser Consulting recommends that a representative from Maser Consulting be on-site on a full-time basis during the earthwork construction.

8. CLOSING

The conclusions and recommendations presented in this report are based, in part, on the explorations accomplished for this evaluation. The number, location, and depth of the explorations were completed within the constraints of budget and site access so as to yield the information to formulate the recommendations. It is recommended that we be provided the opportunity for general review of the project plans and specifications when they become available, in order to confirm that the recommendations and design considerations presented in this report have been properly interpreted and implemented into the project design package.



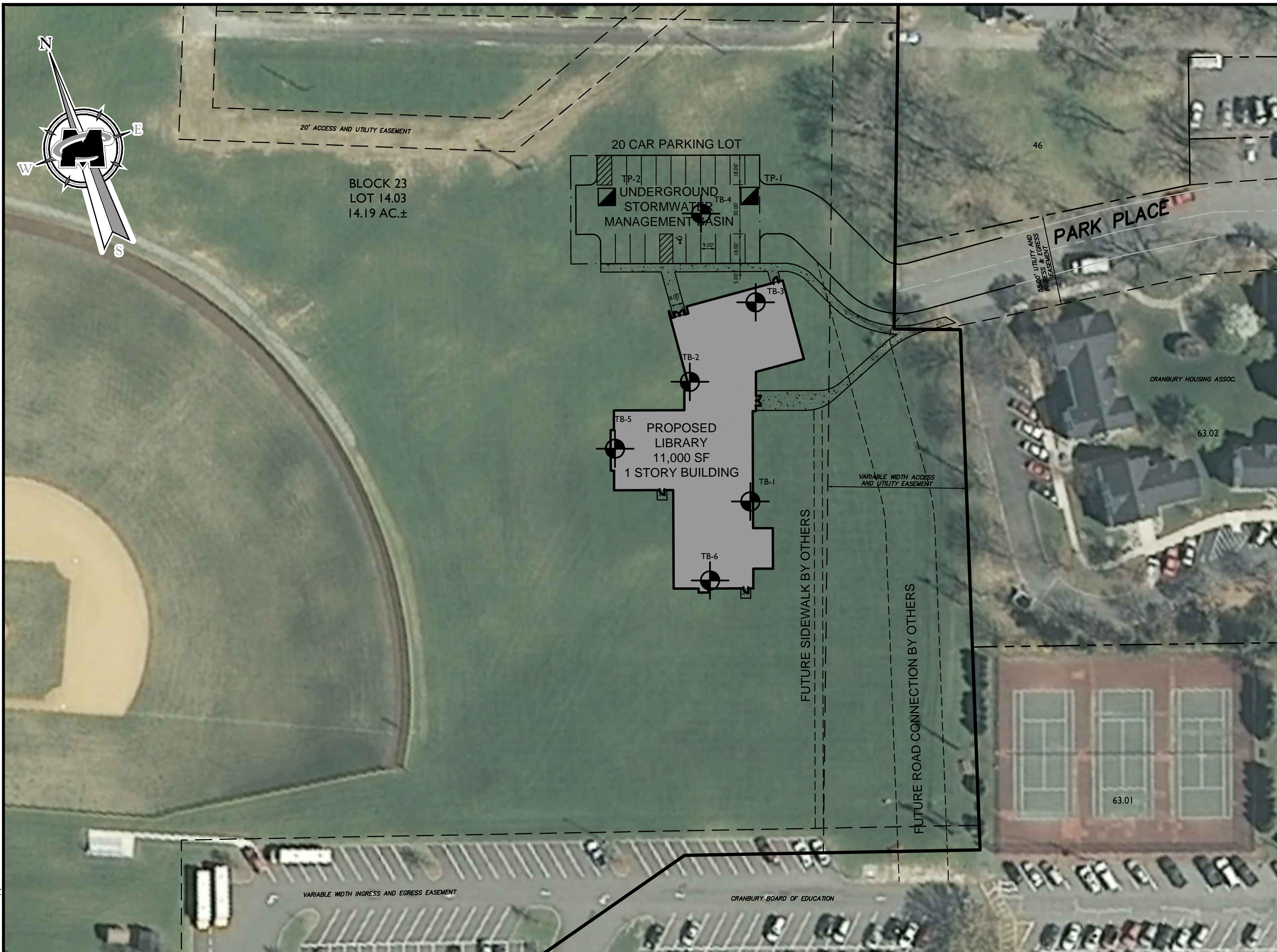
It is emphasized that this evaluation should not be made directly available to prospective bidders. We do; however, recommend that the test boring logs be a part of the specifications for the project along with a reference to the plan sheets that contain the test boring locations for informational purposes. Should the data not be adequate for the Contractor's purposes, the Contractor may make, prior to bidding, his own explorations, tests and analyses.

9. LIMITATIONS

This report has been prepared in accordance with generally accepted geotechnical design practices for specific application to this project. This report has been based on assumed conditions and characteristics of the proposed development where specific information was not available.

The conclusions and recommendations contained in this report are based upon the subsurface data obtained during this exploration and on details stated in this report. The validity of the projections, conclusions and recommendations contained in this report is necessarily limited by the scope of field investigation and by the number of borings that were performed. Should conditions arise which differ from those described in this report, Maser Consulting should be notified immediately and provided with all information, when available, regarding subsurface conditions.

The recommendations contained herein are based upon the assumption that the services of a qualified geotechnical engineer will be retained for the observation of stripping operations, proof-rolling, structural fill placement, and all critical earthwork operations. The scope of this exploration was limited to the evaluation of the load-carrying capabilities and load stability of the subsurface soils. Oil, hazardous/contaminated waste, radioactivity, irritants, pollutants, radon or other dangerous substances and conditions were not the subject of this study. Their presence and/or absence are not implied, inferred or suggested by this report or results of this study.



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REV	DATE	DRAWN BY	DESCRIPTION	REVISED PER CLIENT	
				REVISED PER CLIENT	REVISED PER CLIENT
1	04/05/16	MIT			
2	6/30/2016	JM			

MICHAEL CARNIVALE III
NEW JERSEY PROFESSIONAL
ENGINEER - LICENSE NUMBER: GE45357

**GEOTECHNICAL
EXPLORATION PLAN**

FOR
CRANBURY LIBRARY

BLOCK 23
LOT 14.03

CRANBURY TOWNSHIP
MIDDLESEX COUNTY
NEW JERSEY

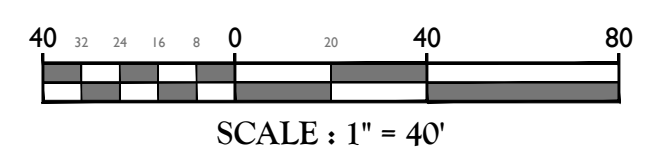
HAMILTON OFFICE
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Fax: 609.587.8260

SCALE: 1"=40'	DATE: 10/09/15	DRAWN BY: JM	CHECKED BY: MC
PROJECT NUMBER: 15001826A	DRAWING NAME: C-CNPT-03-GEO-EXPL		

SHEET TITLE:
CONCEPT PLAN

SHEET NUMBER:
1 of 1

- NOTES:**
- BOUNDARY SHOWN HEREON IS APPROXIMATE AND IS TAKEN FROM THE CRANBURY TOWNSHIP TAX MAPS AND AVAILABLE GIS DATA.
 - AERIAL DATA TAKEN FROM NJGIN 2012 ORTHOPHOTOGRAPHY.
 - PROPOSED LIBRARY FOOTPRINT TAKEN FROM ARCHITECTURAL PLAN PROVIDED BY ARCARI AND IOVINO ARCHITECTS.
 - THE SUBJECT PROPERTY IS LOCATED WITHIN THE RLD-3 ZONE.



15001826A Engineering Concept C-CNPT-03-GEO-EXPL.dwg (C:\CADD\CONCEPT 3 18x24 By: JHOINA



APPENDIX A

TEST BORING LOGS

VISUAL IDENTIFICATION OF SAMPLES
(Burmister Soil Classification System)

I. Definition of Soil Components and Fractions

<u>Material</u>	<u>Symbol</u>	<u>Fraction</u>	<u>Sieve Size</u>	<u>Definition</u>
Boulders	Bldr	-----	9" +	Material retained on 9" sieve.
Cobbles	Cbl	----	3" to 9"	Material passing the 9" sieve and retained on the 3" sieve.
Gravel	G	coarse (c) medium (m) fine (f)	1" to 3" 3/8" to 1" No. 10 to 3/8"	Material passing the 3" sieve and retained on the No. 10 sieve.
Sand	S	coarse (c) medium (m) fine (f)	No. 30 to No. 10 No. 60 to No. 30 No. 200 to No. 60	Material passing the No. 10 sieve and retained on the No. 200 sieve.
Silt	\$	---	Passing No. 200 (0.075 mm)	Material passing the No. 200 sieve that is non-plastic in character and exhibits little or no strength when air dried.
Clayey SILT	Cy\$	Slight (SL)	1 to 5	Clay - Soil
SILT & CLAY	\$ & C	Low (L)	5 to 10	Material passing the No. 200 which can be made to exhibit plasticity and clay qualities within a certain range of moisture content, and which exhibits considerable strength when air-dried.
CLAY & SILT	C & \$	Medium (M)	10 to 20	
Silty CLAY	\$yC	High (H)	20 to 40	
CLAY	C	Very High (VH)	40 Plus	
Organic Silt	(O\$)			Material passing the No. 200 sieve which exhibits plastic properties within a certain range of moisture content, and exhibits fine granular and organic characteristics.

II. Definition of Component Proportions

<u>Component</u>	<u>Written</u>	<u>Proportions</u>	<u>Symbol</u>	<u>Percentage Range by Weight*</u>
Principal	CAPITALS	---		50 or more
Minor	Lower Case	and	a.	35 to 50
		some	s.	20 to 35
		little	l.	10 to 20
		trace	t.	1 to 10

* Minus sign (-) lower limit, plus sign (+) upper limit, no sign middle range.



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PROJECT New Cranbury Library
Cranbury Library Foundation
Middlesex, New Jersey
PROJECT NO. 15001826A

BORING NO. TB-1
PAGE 1 OF 1
LOCATION SEE PLAN
OFFSET _____

CONTRACTOR: Granese Drilling Inc.
DRILLER: Mike Granese
DRILLING EQUIPMENT: CME 61 Rig
METHOD: HSA Mud Rotary _____ Other _____
HAMMER: CH _____ Safety Automatic _____
RODS: AW NW _____ Other _____
INSPECTOR: Jordy Moina

GROUNDWATER: DEPTH (ft.) DATE
First Encountered 20.0' 6/27/16
End of Drilling (0 hrs.) _____
After Drilling (>24 hrs.) _____

DATE STARTED 6/27/16
DATE FINISHED 6/27/16
GROUND ELEV. _____
GROUND WATER ELEV. _____

DEPTH BELOW SURFACE (ft)	SAMPLE NUMBER	BLOWS PER 6 INCHES				RECOVERY (in)	POCKET PENETR-OMETER (tsf)	PROFILE CHANGE DEPTH ELEV.	IDENTIFICATION OF SOILS / REMARKS	
		0-6"	6-12"	12-18"	18-24"					
0	S-1 0'-2'	4	14	20	14	14		S-1: Top 10": Topsoil. Bot 4": Brown Clayey SILT, mf Sand, little mf Gravel, occasional roots		
	S-2 2'-4'	8	9	6	5				14	S-2: Top 8": Same as S-1 Bot. Bot 6": Brown cmf SAND, little cmf Gravel, trace(+) Clayey Silt. (Moist)
	S-3 4'-6'	5	13	13	24				15	S-3: Top 10": Same as S-2 Bot. Bot 5": Yellow cm(+)f SAND, trace(-) Silt, little mf Gravel.
	S-4 6'-8'	21	24	20	26				18	S-4: Top 8": Yellow/Brown cm(+)f SAND, little(+) cmf(+) Gravel, trace(-) Silt, occasional cobbles.
	S-5 8'-10'	15	28	26	20				16	Bot 10": Lt. Yellow cm(+)f SAND, trace f Gravel, trace(-) Silt.
	S-6 10'-12'	22	19	22	26				20	S-5: Top 8": Same as S-4 Bot. Bot 8": Lt. Yellow/Gray cmf GRAVEL, and(+) cmf Sand, trace(-) Silt, occasional roots.
10	S-7 15'-17'	8	14	12	12	16	S-6: Top 6": Same as S-5 Bot. Bot 14": Yellow/Brown cmf SAND, little(+) cm(+)f Gravel, trace(-) Silt.	S-7: Dk. Orange/Yellow cmf SAND, little(+) cmf Gravel, trace(+) Clayey Silt.		
	S-8 20'-22'	11	11	12	9	16	S-8: Same as S-7. (Wet)			
	S-9 25'-27'	7	8	7	9	18	S-9: V. Dk. Gray Silty CLAY, little(+) mf(+) Sand, frequent mf sand seams			
END OF TEST BORING AT 27.0 FEET.										
30										
40										

NOTES:

VISUAL IDENTIFICATION OF SOILS (BURMISTER CLASSIFICATION SYSTEM)

Component	Proportions	% Range (by weight)
PRINCIPAL	---	50 or more
Minor	and	35 to 50
	some	20 to 35
	little	10 to 20
	trace	1 to 10

Clayey Soils	
Clayey SILT	slight Pl.
SILT & CLAY	low Pl.
CLAY & SILT	medium Pl.
Silty CLAY	high Pl.
CLAY	very high Pl.

TERMINOLOGY for STRATIFIED SOILS

Term	Definition
parting	0 to 1/16" thickness
seam	1/16" to 1/2" thickness
layer	1/2" to 12" thickness
occasional	one or less per foot of thickness
frequent	more than one per foot of thickness



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BORING NO. TB-2
PAGE 1 OF 1
LOCATION SEE PLAN
OFFSET _____

CONTRACTOR: Granese Drilling Inc.
DRILLER: Mike Granese
DRILLING EQUIPMENT: CME 61 Rig
METHOD: HSA Mud Rotary _____ Other _____
HAMMER: CH _____ Safety Automatic _____
RODS: AW NW _____ Other _____
INSPECTOR: Jordy Moina

GROUNDWATER: DEPTH (ft.) DATE
First Encountered 21.5' 6/27/16
End of Drilling (0 hrs.) _____
After Drilling (>24 hrs.) _____

DATE STARTED 6/27/16
DATE FINISHED 6/27/16
GROUND ELEV. _____
GROUND WATER ELEV. _____

DEPTH BELOW SURFACE (ft)	SAMPLE NUMBER	BLOWS PER 6 INCHES				RECOVERY (in)	POCKET PENETR-OMETER (tsf)	PROFILE CHANGE DEPTH ELEV.	IDENTIFICATION OF SOILS / REMARKS
		0-6"	6-12"	12-18"	18-24"				
0	S-1	6	6	4	3	16		S-1: Top 6": Topsoil. Bot 10": Brown Clayey SILT, some(+) mf Sand, little(-) f Gravel, occasional roots.	
	0'-2'								
	S-2	3	3	4	5	14		S-2: Top 4": Same as S-1 Bot. Bot 10": Orange/Brown CLAY & SILT, little mf Sand, little(-) f Gravel.	
	2'-4'								
	S-3	4	11	15	13	15		S-3: Top 5": Same as S-2 Bot. Bot 10": Lt. Yellow/Brown cmf GRAVEL, and cmf Sand, trace Silt.	
	4'-6'								
	S-4	15	24	26	28	20		S-4: Same as S-3 Bot.	
	6'-8'								
	S-5	15	12	7	12	16		S-5: Top 12": Same as S-3 Bot. Bot 4": Yellow/Brown CLAY & SILT, some(-) mf Sand, trace(-) f Gravel, occasional seams.	
	8'-10'								
10	S-6	17	17	19	12	16		S-6: Top 6": Brown cmf SAND, some Clayey Silt, little mf Gravel. Bot 10": Yellow/Brown c(+)mf SAND, little(+) mf Gravel, trace(+) Clayey Silt. (Moist)	
	10'-12'								
	S-7	7	9	10	12	22		S-7: Orange/Yellow c(+)mf SAND, little(+) mf Gravel, little Clayey Silt. (Moist)	
	15'-17'								
20	S-8	9	8	6	5	20		S-8: Same as S-7.	
	20'-22'								
	S-9	9	10	13	12	1		S-9: V. Dk. Gray Silty CLAY, little(-) mf Sand, trace(-) f Gravel, frequent gray mf Sand seams, (Wet Seams).	
	25'-27'								
END OF TEST BORING AT 27.0 FEET.									
30									
40									

NOTES:

VISUAL IDENTIFICATION OF SOILS (BURMISTER CLASSIFICATION SYSTEM)

Component	Proportions	% Range (by weight)
PRINCIPAL	---	50 or more
Minor	and	35 to 50
	some	20 to 35
	little	10 to 20
	trace	1 to 10

Clayey Soils	
Clayey SILT	slight Pl.
SILT & CLAY	low Pl.
CLAY & SILT	medium Pl.
Silty CLAY	high Pl.
CLAY	very high Pl.

TERMINOLOGY for STRATIFIED SOILS

Term	Definition
parting	0 to 1/16" thickness
seam	1/16" to 1/2" thickness
layer	1/2" to 12" thickness
occasional	one or less per foot of thickness
frequent	more than one per foot of thickness



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PROJECT NO. 15001826A

BORING NO. TB-3
PAGE 1 OF 1
LOCATION SEE PLAN
OFFSET _____

CONTRACTOR: Granese Drilling Inc.
DRILLER: Mike Granese
DRILLING EQUIPMENT: CME 61 Rig
METHOD: HSA Mud Rotary _____ Other _____
HAMMER: CH _____ Safety Automatic _____
RODS: AW NW _____ Other _____
INSPECTOR: Jordy Moina

GROUNDWATER: DEPTH (ft.) DATE
First Encountered 20' 6/27/16
End of Drilling (0 hrs.) _____
After Drilling (>24 hrs.) _____

DATE STARTED 6/27/16
DATE FINISHED 6/27/16
GROUND ELEV. _____
GROUND WATER ELEV. _____

DEPTH BELOW SURFACE (ft)	SAMPLE NUMBER	BLOWS PER 6 INCHES				RECOVERY (in)	POCKET PENETR-OMETER (tsf)	PROFILE CHANGE DEPTH ELEV.	IDENTIFICATION OF SOILS / REMARKS
		0-6"	6-12"	12-18"	18-24"				
0	S-1	9	10	8	37	14		S-1: Top 8": Topsoil. Bot 6": Brown Clayey SILT, some(+) mf Sand, little cmf Gravel, Occasional fine roots.	
	0'-2'								
	S-2	5	6	9	10	6		S-2: Yellow Brown cmf SAND, little(+) cmf Gravel, little(-) Clayey Silt, Large concrete fragment at top.	
	2'-4'								
	S-3	5	5	5	6	14		S-3: Lt. Brown CLAY and SILT, some cm(+)f Sand, little cm(+)f Gravel.	
	4'-6'								
	S-4	8	6	6	9	6		S-4: Same as S-3.	
	6'-8'								
	S-5	14	18	18	16	15		S-5: Lt. Yellow cmf SAND, little mf Gravel, trace(-) Silt.	
	8'-10'								
10	S-6	14	10	7	7	18		S-6: Top 8": Same as S-5. Bot 10": Yellow/Brown cmf SAND, little Clayey Silt, little cmf Gravel.	
	10'-12'								
	S-7	5	9	6	6	10		S-7: Yellow/Brown cmf SAND, little Clayey Silt, little mf Gravel.	
	15'-17'								
20	S-8	6	5	6	4	18		S-8: Same as S-7. (Wet)	
	20'-22'								
	S-9	5	6	8	10	16		S-9: V. Dk. Gray Silty CLAY, little mf Sand.	
	25'-27'								
END OF TEST BORING AT 27.0 FEET.									
30									
40									

NOTES:

VISUAL IDENTIFICATION OF SOILS (BURMISTER CLASSIFICATION SYSTEM)

Component	Proportions	% Range (by weight)
PRINCIPAL	---	50 or more
Minor	and	35 to 50
	some	20 to 35
	little	10 to 20
	trace	1 to 10

Clayey Soils	
Clayey SILT	slight Pl.
SILT & CLAY	low Pl.
CLAY & SILT	medium Pl.
Silty CLAY	high Pl.
CLAY	very high Pl.

TERMINOLOGY for STRATIFIED SOILS

Term	Definition
parting	0 to 1/16" thickness
seam	1/16" to 1/2" thickness
layer	1/2" to 12" thickness
occasional	one or less per foot of thickness
frequent	more than one per foot of thickness



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PROJECT NO. 15001826A

BORING NO. TB-4
PAGE 1 OF 1
LOCATION SEE PLAN
OFFSET _____

CONTRACTOR: Granese Drilling Inc.
DRILLER: Mike Granese
DRILLING EQUIPMENT: CME 61 Rig
METHOD: HSA Mud Rotary _____ Other _____
HAMMER: CH _____ Safety Automatic _____
RODS: AW NW _____ Other _____
INSPECTOR: Jordy Moina

GROUNDWATER: DEPTH (ft.) DATE
First Encountered N.E 6/27/16
End of Drilling (0 hrs.) _____
After Drilling (>24 hrs.) _____

DATE STARTED 6/27/16
DATE FINISHED 6/27/16

GROUND ELEV. _____
GROUND WATER ELEV. _____

DEPTH BELOW SURFACE (ft)	SAMPLE NUMBER	BLOWS PER 6 INCHES				RECOVERY (in)	POCKET PENETR-OMETER (tsf)	PROFILE CHANGE DEPTH ELEV.	IDENTIFICATION OF SOILS / REMARKS
		0-6"	6-12"	12-18"	18-24"				
0	S-1	15	16	24	14	16		S-1: Top 8": Topsoil.	
	0'-2'							Bot 8": Brown Clayey SILT, some(+) mf Sand, little mf Gravel, occasional roots.	
	S-2	8	9	11	12	12		S-2: Orange Brown CLAY & SILT, little(+) mf Sand, little(-) mf Gravel.	
	2'-4'								
	S-3	9	10	8	7	18		S-3: Dk. Orange/Brown SILT & CLAY, some(+) cmf Sand, little mf Gravel. (Moist)	
	4'-6'								
	S-4	11	15	13	11	20		S-4: Top 8": Same as S-3.	
	6'-8'							Bot 12": Yellow/Brown cmf SAND, little(+) Clayey Silt, trace f Gravel. (Moist)	
10								END OF TEST BORING AT 8.0 FEET.	
20									
30									
40									

NOTES:

VISUAL IDENTIFICATION OF SOILS (BURMISTER CLASSIFICATION SYSTEM)

Component	Proportions	% Range (by weight)
PRINCIPAL	---	50 or more
Minor	and	35 to 50
	some	20 to 35
	little	10 to 20
	trace	1 to 10

Clayey Soils	
Clayey SILT	slight Pl.
SILT & CLAY	low Pl.
CLAY & SILT	medium Pl.
Silty CLAY	high Pl.
CLAY	very high Pl.

TERMINOLOGY for STRATIFIED SOILS

Term	Definition
parting	0 to 1/16" thickness
seam	1/16" to 1/2" thickness
layer	1/2" to 12" thickness
occasional	one or less per foot of thickness
frequent	more than one per foot of thickness



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Cranbury Library Foundation
Middlesex, New Jersey
PROJECT NO. 15001826A

BORING NO. TB-5
PAGE 1 OF 1
LOCATION SEE PLAN
OFFSET _____

CONTRACTOR: Granese Drilling Inc.
DRILLER: Mike Granese
DRILLING EQUIPMENT: CME 61 Rig
METHOD: HSA Mud Rotary _____ Other _____
HAMMER: CH _____ Safety Automatic _____
RODS: AW NW _____ Other _____
INSPECTOR: Jordy Moina

GROUNDWATER: DEPTH (ft.) DATE
First Encountered 21.0' 6/27/16
End of Drilling (0 hrs.) _____
After Drilling (>24 hrs.) _____

DATE STARTED 6/27/16
DATE FINISHED 6/27/16
GROUND ELEV. _____
GROUND WATER ELEV. _____

DEPTH BELOW SURFACE (ft)	SAMPLE NUMBER	BLOWS PER 6 INCHES				RECOVERY (in)	POCKET PENETR-OMETER (tsf)	PROFILE CHANGE DEPTH ELEV.	IDENTIFICATION OF SOILS / REMARKS
		0-6"	6-12"	12-18"	18-24"				
0	S-1	8	15	16	8	14		S-1: Top 8": Topsoil. Bot 6": Brown Clayey SILT, some cm(+)f Sand, little mf Gravel, occasional fine roots.	
	0'-2'								
	S-2	6	8	14	18	14		S-2: Orange/Brown SILT & CLAY, little(+) mf Sand, little mf Gravel, occasional roots.	
	2'-4'								
	S-3	9	10	12	13	18		S-3: Top 4": Same as S-2. Bot 14": Brown c(+)mf SAND, little(+) c(-)mf Gravel, little Clayey Silt.	
	4'-6'								
	S-4	18	18	18	15	16		S-4: Top 6": Same as S-3 Bot. Bot 10": Yellow/Brown cmf SAND, little(+) Clayey Silt, little mf Gravel.	
	6'-8'								
	S-5	8	15	19	17	14		S-5: Yellow/Brown cmf SAND, little mf(+) Gravel, trace(-) Silt.	
	8'-10'								
10	S-6	15	7	8	8	18		S-6: Top 8": Same as S-5. Bot 10": Same as S-4 Bot.	
	10'-12'								
	S-7	9	9	9	9	16		S-7: Yellow/Brown cmf SAND, little f Gravel, little(-) Clayey Silt.	
	15'-17'								
	S-8	9	6	25	20	10		S-8: Top 4": Same as S-7. Mid: Gray c GRAVEL. Bot 4": Gray mf(+) SAND, little(-) Clayey Silt, frequent strong brown seams	
	20'-22'								
	S-9	5	6	12	13	16		S-9: Top 6": Gray Silty CLAY, little mf(+) Sand, trace(-) f Gravel. Bot 12": Lt. Gray mf SAND, little Silt, frequent Silty Clay seams.	
	25'-27'								
END OF TEST BORING AT 27.0 FEET.									
30									
40									

NOTES:

VISUAL IDENTIFICATION OF SOILS (BURMISTER CLASSIFICATION SYSTEM)			TERMINOLOGY for STRATIFIED SOILS		
Component	Proportions	% Range (by weight)	Clayey Soils	Term	Definition
PRINCIPAL	---	50 or more	Clayey SILT	parting	0 to 1/16" thickness
Minor	and	35 to 50	SILT & CLAY	seam	1/16" to 1/2" thickness
	some	20 to 35	CLAY & SILT	layer	1/2" to 12" thickness
	little	10 to 20	Silty CLAY	occasional	one or less per foot of thickness
	trace	1 to 10	CLAY	frequent	more than one per foot of thickness



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PROJECT New Cranbury Library
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Middlesex, New Jersey
PROJECT NO. 15001826A

BORING NO. TB-6
PAGE 1 OF 1
LOCATION SEE PLAN
OFFSET _____

CONTRACTOR: Granese Drilling Inc.
DRILLER: Mike Granese
DRILLING EQUIPMENT: CME 61 Rig
METHOD: HSA Mud Rotary _____ Other _____
HAMMER: CH _____ Safety Automatic _____
RODS: AW NW _____ Other _____
INSPECTOR: Jordy Moina

GROUNDWATER: DEPTH (ft.) DATE
First Encountered 20.0' 6/27/16
End of Drilling (0 hrs.) _____
After Drilling (>24 hrs.) _____

DATE STARTED 6/27/16
DATE FINISHED 6/27/16
GROUND ELEV. _____
GROUND WATER ELEV. _____

DEPTH BELOW SURFACE (ft)	SAMPLE NUMBER	BLOWS PER 6 INCHES				RECOVERY (in)	POCKET PENETR-OMETER (tsf)	PROFILE CHANGE DEPTH ELEV.	IDENTIFICATION OF SOILS / REMARKS
		0-6"	6-12"	12-18"	18-24"				
0	S-1	10	20	19	18			S-1: Top 8": Topsoil. Bot 8": Brown Clayey SILT, some mf Sand, little mf Gravel, occasional root (subsoil).	
	0'-2'							S-2: Top 3": Same as S-1 Bot. Bot *": Orange/Brown cmf SAND, little Clayey Silt, little mf Gravel.	
	S-2	6	17	18	19			S-3: Top 8": Same as S-2 Bot. Bot 8": Yellow/Brown cm(+)-f SAND, trace(+) Silt, little mf Gravel.	
	2'-4'							S-4: Same as S-2 Bot.	
	S-3	14	13	13	15			S-5: Top 6": Same as S-2 Bot. Bot 10": cmf GRAVEL, and(+) cmf Sand, trace Silt	
	4'-6'							S-6: Top 12": Same as S-5 Bot. Bot 6": Gray/Yellow cmf SAND, little(+) Clayey Silt, little mf(+) Gravel.	
	S-4	18	20	18	19				
	6'-8'								
	S-5	17	33	38	51				
	8'-10'								
10	S-6	24	18	17	18			S-7: Lt. Yellow cmf SAND, little(+) Clayey Silt, little cmf Gravel, occasional Silty Clay seams and layers, occasional wet seams.	
	10'-12'								
20	S-7	7	8	8	11			S-8: Top 14": Same as S-7. Bot 6": Red/Orange SILT and CLAY, and(+) cmf Sand, little(-) f Gravel. (Wet)	
	15'-17'								
30	S-8	8	8	8	6			END OF TEST BORING AT 22.0 FEET.	
	20'-22'								
40									

NOTES:

VISUAL IDENTIFICATION OF SOILS (BURMISTER CLASSIFICATION SYSTEM)

Component	Proportions	% Range (by weight)
PRINCIPAL	---	50 or more
Minor	and	35 to 50
	some	20 to 35
	little	10 to 20
	trace	1 to 10

Clayey Soils	
Clayey SILT	slight Pl.
SILT & CLAY	low Pl.
CLAY & SILT	medium Pl.
Silty CLAY	high Pl.
CLAY	very high Pl.

TERMINOLOGY for STRATIFIED SOILS

Term	Definition
parting	0 to 1/16" thickness
seam	1/16" to 1/2" thickness
layer	1/2" to 12" thickness
occasional	one or less per foot of thickness
frequent	more than one per foot of thickness

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 2. Section 014000 "Quality Requirements" for field testing by an independent testing agency.

1.3 DEFINITIONS

- A. Unit price is a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in the Bid Form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other work of the Contract.
- C. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 1 (Circulation Desk): Provide and install the millwork as shown on the Contract Drawings. Include all blocking, fasteners, etc. required for installation.
- B. Alternate No. 2 (Circulation Storage Cabinets): Provide and install the millwork as shown on the Contract Drawings. Include all blocking, fasteners, etc. required for installation.
- C. Alternate No. 3 (Reference): Provide and install the millwork as shown on the Contract Drawings. Include all blocking, fasteners, etc. required for installation.
- D. Alternate No. 4 (Building Signage): Provide and install the building signage as shown on the Contract Drawings. Include all blocking, fasteners, etc. required for installation.

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - b. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - c. Product Data, including drawings and descriptions of products and fabrication and installation procedures.

- d. Samples, where applicable or requested.
 - e. Certificates and qualification data, where applicable or requested.
 - f. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - g. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - h. Cost information, including a proposal of change, if any, in the Contract Sum.
 - i. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - j. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

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

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 30 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Substitution request is fully documented and properly submitted.
 - e. Requested substitution will not adversely affect Contractor's construction schedule.
 - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - g. Requested substitution is compatible with other portions of the Work.
 - h. Requested substitution has been coordinated with other portions of the Work.
 - i. Requested substitution provides specified warranty.
 - j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within 10 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Use forms acceptable to Architect.

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

1.5 CHANGE ORDER PROCEDURES

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

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.

- e. Date of submittal.
2. Arrange schedule of values consistent with format of AIA Document G703.
3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 - a. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.
10. Refer to the sample form at the end of this section. Line items should be modified based on the specific requirements of the project. Items listed with percentage values are required and indicate the minimum value acceptable.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: Submit Application for Payment to Architect by the 5th of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
 - 1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
- D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 - 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 - 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
 - 4. Provide schedule updates, daily reports, and progress photos with each payment application.
- F. Stored Materials: If payment of stored materials is approved by owner, include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 - 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 - 3. Provide summary documentation for stored materials indicating the following:
 - a. Applications for Payment. Value of materials previously stored and remaining stored as of date of previous
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- G. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
- H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
 - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.

2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.
- I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Submittal schedule (preliminary if not final).
 5. List of Contractor's staff assignments.
 6. List of Contractor's principal consultants.
 7. Copies of building permits.
 8. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 9. Certificates of insurance and insurance policies.
 10. Performance and payment bonds with copy of check to Bonding Company.
 11. Data needed to acquire Owner's insurance.
- J. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- K. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

Sample of Schedule of Values

Items in bold are required, modify all other line items to suit project requirements

Item	Work Description
1	Mobilization
2	Bond (amount must match cancelled check to Bond Company)
3	General Conditions
4	Submittals
5	Submittal Schedule (0.25% min)
6	Coordination Drawings (0.25% min)
7	Mockup (0.25% min)
8	Photo Documentation (0.25% min)
9	Construction Schedules (0.50% min)
10	Daily Construction Reports (0.50% min)
11	Quality Control Plan (0.25% min)
12	Engineering & layout
	<u>Division 2 Site Work</u>
13	Site Clearing
14	Building Excavation
15	Utilities Excavation
16	Storm Materials
17	Storm Labor
18	Site Structures materials
19	Site Structures labor
20	Site Structures stone
21	Sewer Excavation
22	Sewer connections
23	PVC pipe
24	Cleanouts
25	Concrete curb
26	Concrete sidewalk
27	Asphalt Paving
28	Construction Entrance Pad
29	Silt fence
30	Landscaping
	<u>Division 3 Concrete</u>
31	Footings
32	Slab on Grade
33	Slab rebar
34	6" crushed stone

Division 5 Metals

- 35 Exterior metal framing materials
- 36 Exterior metal framing labor
- 37 Steel shop drawings
- 38 Steel materials
- 39 Steel erection
- 40 Metal deck material
- 41 Metal deck labor
- 42 Metal fabrication

Division 6 Wood and Plastic

- 43 Wood blocking
- 44 Sheathing

Division 7 Thermal and Moisture Protection

- 45 Bituminous dampproofing
- 46 Building insulation
- 47 Asphalt shingles
- 48 Roofing membrane material
- 49 Roofing membrane labor
- 50 Roof insulation
- 51 Flashing and trim
- 52 Roof specialties
- 53 Roof accessories
- 54 Joint sealants
- 55 Vapor barrier
- 56 Fireproofing

Division 8 Doors and Windows

- 57 Steel doors materials
- 58 Steel doors labor
- 59 Steel frames materials
- 60 Steel frames labor
- 61 Wood doors materials
- 62 Wood doors labor
- 63 Access doors
- 64 Storefront system materials
- 65 Storefront system labor
- 66 Windows materials
- 67 Windows labor
- 68 Door hardware materials
- 69 Door hardware labor
- 70 Glazing materials

- 71 Glazing labor
- Division 9 Finishes
- 72 Interior framing materials
- 73 Interior framing labor
- 74 GWB materials
- 75 GWB labor
- 76 Ceramic Tile
- 77 ACT materials
- 78 ACT labor
- 79 VCT materials
- 80 VCT labor
- 81 Vinyl base materials
- 82 Vinyl base labor
- 83 Carpet materials
- 84 Carpet labor
- 85 Paint exterior
- 86 Paint interior

Division 10 Specialties

- 87 Toilet partitions
- 88 Fire extinguisher cabinets
- 89 Fire extinguishers
- 90 Toilet accessories
- 91 Signage

Division 12 Furnishings

- 92 Millwork

Division 13 Special Construction

- 93 Special Construction items

Division 15 Mechanical

- 94 HVAC submittals
- 95 HVAC materials
- 96 HVAC labor
- 97 Ductwork materials
- 98 Ductwork labor
- 99 Piping Materials
- 100 Piping labor
- 101 Plumbing Submittals
- 102 Plumbing materials
- 103 Plumbing labor
- 104 Underground piping

Division 16 Electrical

- 105 Electrical submittals
- 106 Lighting materials
- 107 Lighting labor
- 108 Power materials
- 109 Power labor
- 110 Electric service materials
- 111 Electric service labor
- 112 Fire alarm materials
- 113 Fire alarm labor

- 114 Punch List (0.25% min)**
- 115 Owner Training (0.25% min)**
- 116 As-built Drawings (0.25% min)**

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 7 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1.4 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's construction schedule.
 - 2. Preparation of the schedule of values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Preinstallation conferences.
 - 7. Project closeout activities.
 - 8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
 2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
 6. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
 7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit **1-1/4 inches** in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.

- c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
 - 8. Fire-Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
 - 9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
 - 10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
 - 1. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.

1.6 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 - 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 - 1. Project name.
 - 2. Project number.
 - 3. Date.
 - 4. Name of Contractor.
 - 5. Name of Architect.
 - 6. RFI number, numbered sequentially.
 - 7. RFI subject.
 - 8. Specification Section number and title and related paragraphs, as appropriate.
 - 9. Drawing number and detail references, as appropriate.
 - 10. Field dimensions and conditions, as appropriate.
 - 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 - 12. Contractor's signature.
 - 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

- C. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Use of Architect's Digital Data Files: Digital data files of Architect's CAD drawings may be obtained for a fee for Contractor's use during construction. If interested, contractor must complete the required AIA release form and submit payment for each individual file (A.100, A.101, A.102, etc.) prior to the release of documents.
1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
 2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
 3. Digital Drawing Software Program: Contract Drawings are available in AutoCAD dwg format.
 4. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement.
 - a. Subcontractors, and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of AIA Document C106.

1.8 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Architect will record significant discussions and agreements achieved. Meeting minutes will be distributed to everyone concerned within three days of the meeting.

- B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect.
 - 1. Conduct the conference to review responsibilities and personnel assignments.
 - 2. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Minutes: Architect will record and distribute meeting minutes.

- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
 - 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 - 2. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - 3. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 - 4. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
 - 1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 - 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Minutes: Entity conducting meeting will record and distribute meeting minutes.

- E. Progress Meetings: Architect will conduct progress meetings at regular intervals.
 - 1. Coordinate dates of meetings with preparation of payment requests.
 - 2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Minutes: Architect will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

- F. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - c. Review present and future needs of each contractor present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site utilization.
 - 9) Temporary facilities and controls.
 - 10) Work hours.
 - 11) Hazards and risks.
 - 12) Progress cleaning.
 - 13) Quality and work standards.
 - 14) Change Orders.
 3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's construction schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Site condition reports.
 - 7. Special reports.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
 - 2. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.

- E. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- F. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. 3 paper copies.
- B. Startup construction schedule.
 - 1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 - 3. Total Float Report: List of all activities sorted in ascending order of total float.
- F. Construction Schedule Updating Reports: Submit monthly with Applications for Payment.
- G. Daily Construction Reports: Submit monthly with Application for Payment.
- H. Special Reports: Submit at time of unusual event.

1.5 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 - 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 - 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 - 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 - 1. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.

2. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Building flush-out.
 - m. Startup and placement into final use and operation.
3. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

2.2 STARTUP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven days of date established for the Notice to Proceed.

- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.
 - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for the Notice to Proceed.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 - 2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 3. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
 - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing.
 - j. Punch list and final completion.
 - k. Activities occurring following final completion.
 - 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 - 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.

4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities.

2.4 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site. Submit monthly with Application for Payment:
 1. List of subcontractors at Project site.
 2. Approximate count of personnel at Project site.
 3. Equipment at Project site.
 4. Material deliveries.
 5. High and low temperatures and general weather conditions, including presence of rain or snow.
 6. Accidents.
 7. Meetings and significant decisions.
 8. Unusual events (see special reports).
 9. Stoppages, delays, shortages, and losses.
 10. Emergency procedures.
 11. Orders and requests of authorities having jurisdiction.
 12. Change Orders received and implemented.
 13. Construction Change Directives received and implemented.
 14. Services connected and disconnected.
 15. Equipment or system tests and startups.
 16. Partial completions and occupancies.
 17. Substantial Completions authorized.
- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule before each regularly scheduled progress meeting.
 - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - 3. As the Work progresses, indicate final completion percentage for each activity.

- B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
 - 3. Final completion construction photographs.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting photographic documentation.
 - 2. Section 017700 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.
 - 3. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files each month with Payment Application.
 - 1. Digital Camera: Minimum sensor resolution of 8 megapixels.
 - 2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.

1.4 USAGE RIGHTS

- A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in file name for each image.
- C. Preconstruction Photographs: Before commencement of excavation, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
 - 1. Flag excavation areas before taking construction photographs.
 - 2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
 - 3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 - 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- D. Periodic Construction Photographs: Take 20 photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 5. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 2. Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 3. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled date of fabrication.
 - h. Scheduled dates for purchasing.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic background files of the Contract Drawings may be obtained for a fee for Contractor's use in preparing submittals. Contractor must complete the required AIA release form and submit payment for each file prior to release of documents. Contractor may not reproduce documents for shop drawings without written approval from architect/engineer.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
 4. Sequential Review: Where review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for review of each submittal.
- D. Submittals: Place a label or title block on each submittal item for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 3. Include the following information for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Name of subcontractor.
 - g. Name of supplier.
 - h. Name of manufacturer.
 - i. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
 - j. Number and title of appropriate Specification Section.
 - k. Drawing number and detail references, as appropriate.
 - l. Location(s) where product is to be installed, as appropriate.
 - m. Other necessary identification.
- E. Options: Identify options requiring selection by Architect.
- F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- G. Resubmittals: Make resubmittals in same form as initial submittal.
1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Prepare submittals and shop drawings as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line to reflect the Submittal Number.
 - a. Architect will return annotated file. Retain one copy of file as a digital Project Document file and annotate for closeout documents.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 - 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.

- e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
- 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
 - 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 - 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 - 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 - 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit four sets of Samples. Architect will return two Sample sets.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
- 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 - 2. Manufacturer and product name, and model number if applicable.

3. Number and name of room or space.
 4. Location within room or space.
 5. Submit product schedule in the following format:
 - a. Four paper copies of product schedule or list unless otherwise indicated. Architect will return two copies.
- F. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
 - G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
 - H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."
 - I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
 - J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
 - K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
 - L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
 - M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
 - N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 - O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 - P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
 - Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
 - R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

- S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit four paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
 2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
 - E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
 - F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
 - G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
 - H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
 - I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
 - J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

- A. Shop Drawings: For mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
 - 1. Indicate manufacturer and model number of individual components.
 - 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data : For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 - 1. Project quality-control manager may also serve as Project superintendent.

- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
 - 2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
 - 3. Owner-performed tests and inspections indicated in the Contract Documents.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of technical representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Statement that products at Project site comply with requirements.

4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.9 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

- K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.

2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 7. Demolish and remove mockups when directed unless otherwise indicated.
- L. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

1.10 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

- D. **Manufacturer's Technical Services:** Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. **Retesting/Reinspecting:** Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- F. **Testing Agency Responsibilities:** Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - 6. Do not perform any duties of Contractor.
- G. **Associated Services:** Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. **Coordination:** Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. **Schedule of Tests and Inspections:** Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
 - 1. **Distribution:** Distribute schedule to Owner, Architect testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Coordinate with the site contractor.
- C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
 - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
 - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 - 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

- D. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
 - 1. Locations of dust-control partitions at each phase of work.
 - 2. HVAC system isolation schematic drawing.
 - 3. Location of proposed air-filtration system discharge.
 - 4. Waste handling procedures.
 - 5. Other dust-control measures.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fencing: Provide 4'-0" high orange plastic safety fence with 1.75" x 1.75" mesh size.
- B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- C. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.
- D. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

- B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures".
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
 - 1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
 - 1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - 1. Install electric power service underground unless otherwise indicated.
- H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 - 2. Install lighting for Project identification sign.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
 - 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas as indicated on Drawings.
 - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.

2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Civil Drawings and specifications
 3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Civil Drawings and specifications.
- D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 2. Remove snow and ice as required to minimize accumulations.
- F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Identification Signs: Provide 4'x8' Project identification sign on plywood backer.
 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 3. Maintain and touchup signs so they are legible at all times.
- G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- C. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- D. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- E. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence.

- F. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- G. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- I. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
 - 1. Prohibit smoking in construction areas.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 - 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
 - 1. Protect porous materials from water damage.
 - 2. Protect stored and installed material from flowing or standing water.
 - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 - 4. Remove standing water from decks.
 - 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
 - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 - 2. Keep interior spaces reasonably clean and protected from water damage.
 - 3. Periodically collect and remove waste containing cellulose or other organic matter.
 - 4. Discard or replace water-damaged material.
 - 5. Do not install material that is wet.
 - 6. Discard, replace, or clean stored or installed material that begins to grow mold.
 - 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure, but prior to the full operation of permanent HVAC systems, maintain as follows:
 - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 - 2. Use permanent HVAC system to control humidity.
 - 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 - 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 - 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 1. Store products to allow for inspection and measurement of quantity or counting of units.
 2. Store materials in a manner that will not endanger Project structure.
 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

- B. Product Selection Procedures:
1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 3. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Progress cleaning.
 - 5. Starting and adjusting.
 - 6. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for limits on use of Project site.
 - 2. Section 013300 "Submittal Procedures" for submitting surveys.
 - 3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor.
- B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- D. Certified Surveys: Submit two copies signed by land surveyor.
- E. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.4 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

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

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - 1. Description of the Work.
 - 2. List of detrimental conditions, including substrates.
 - 3. List of unacceptable installation tolerances.
 - 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 2. Establish limits on use of Project site.
 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 4. Inform installers of lines and levels to which they must comply.
 5. Check the location, level and plumb, of every major element as the Work progresses.
 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.

- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 - 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 96 inches.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
 - 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.

2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. **Installed Work:** Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
 - E. **Concealed Spaces:** Remove debris from concealed spaces before enclosing the space.
 - F. **Exposed Surfaces in Finished Areas:** Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
 - G. **During handling and installation,** clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
 - H. **Clean and provide maintenance on completed construction** as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
 - I. **Limiting Exposures:** Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. **Manufacturer's Field Service:** Comply with qualification requirements in Section 014000 "Quality Requirements."

3.8 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Section 013233 "Photographic Documentation" for submitting final completion construction photographic documentation.
 - 2. Section 017300 "Execution" for progress cleaning of Project site.
 - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 5. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.3 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
 - 5. Submit test/adjust/balance records.
 - 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
 - 6. Advise Owner of changeover in heat and other utilities.
 - 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.

8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements, including touchup painting.
 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.

- b. Date.
- c. Name of Architect.
- d. Name of Contractor.
- e. Page number.
- 4. Submit list of incomplete items in the following format:
 - a. Three paper copies.

1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - 1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
 - p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - q. Leave Project clean and ready for occupancy.

- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

- a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.
- 2. Two paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will not return any copies.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
 - 1. List of documents.
 - 2. List of systems.
 - 3. List of equipment.
 - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- B. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.
 - 6. Name and contact information for Architect.
 - 7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 - 8. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
 - 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
 - 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

- a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
 4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 1. Fire.
 2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
 1. Instructions on stopping.
 2. Shutdown instructions for each type of emergency.
 3. Operating instructions for conditions outside normal operating limits.
 4. Required sequences for electric or electronic systems.
 5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor has delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.

- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.

- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

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

- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

- E. **Manufacturers' Data:** Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

- F. **Drawings:** Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original project record documents as part of operation and maintenance manuals.
 - 2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."

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

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Product Data.
 - 3. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for final property survey.
 - 2. Section 017700 "Closeout Procedures" for general closeout procedures.
 - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit pdf set of marked-up record prints.
 - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit three paper-copy sets of marked-up record prints.
 - 2) Submit PDF electronic files of scanned record prints.
 - 3) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Product Data: Submit one paper copy and annotated PDF electronic files and directories of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- C. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy and annotated PDF electronic files and directories of each submittal.

- D. Reports: Submit written report monthly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 - 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 - 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
 - 1. Format: Annotated PDF electronic file.
 - 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 - 3. Refer instances of uncertainty to Architect for resolution.

- C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
 - 1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 - 2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

- D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 - 1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 - 2. Format: Annotated PDF electronic file.
 - 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 - 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 - 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
 - 5. Note related Change Orders, record Product Data, and record Drawings where applicable.

- B. Format: Submit record Specifications as annotated PDF electronic file.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders and record Drawings where applicable.
- B. Format: Submit record Product Data as paper copy and scanned PDF electronic files of marked-up paper copy of Product Data.
 - 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as paper copy and scanned PDF electronic files of marked-up miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
- B. Qualification Data: For facilitator.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.

- f. Safety procedures.
- g. Instructions on stopping.
- h. Normal shutdown instructions.
- i. Operating procedures for emergencies.
- j. Operating procedures for system, subsystem, or equipment failure.
- k. Seasonal and weekend operating instructions.
- l. Required sequences for electric or electronic systems.
- m. Special operating instructions and procedures.
- 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
 - 2. Owner will furnish an instructor to describe Owner's operational philosophy.
 - 3. Owner will furnish Contractor with names and positions of participants.

- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner with at least seven days' advance notice.

- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

- E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900

SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Formwork for cast-in place concrete.
 - 2. Shoring, bracing, and anchorage.
 - 3. Form accessories.
 - 4. Form stripping.
- B. Related Sections:
 - 1. Section 03 20 00 - Concrete Reinforcing.
 - 2. Section 03 30 00 - Cast-In-Place Concrete.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT – NOT USED

1.3 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
 - 2. ACI 301 - Specifications for Structural Concrete.
 - 3. ACI 318 - Building Code Requirements for Structural Concrete.
 - 4. ACI 347 - Guide to Formwork for Concrete.
- B. American Forest and Paper Association:
 - 1. AF&PA - National Design Specifications for Wood Construction.
- C. The Engineered Wood Association:
 - 1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.
- D. American Society of Mechanical Engineers:
 - 1. ASME A17.1 - Safety Code for Elevators and Escalators.
- E. ASTM International:
 - 1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - 2. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
- F. West Coast Lumber Inspection Bureau:
 - 1. WCLIB - Standard Grading Rules for West Coast Lumber.

1.4 DESIGN REQUIREMENTS

- A. Design, engineer and construct formwork, shoring and bracing in accordance with ACI 318 to conform to design and applicable Township and State code requirements to achieve concrete shape, line and dimension as indicated on Drawings.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 347, ACI 301, ACI 318.
- B. For wood products furnished for work of this Section, comply with AF&PA.
- C. Perform Work in accordance with NJDOT Standards.

1.6 QUALIFICATIONS

- A. Design formwork under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of New Jersey.

1.7 COORDINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate this Section with other sections of work, requiring attachment of components to formwork.

PART 2 - PRODUCTS

2.1 WOOD FORM MATERIALS

- A. Form Materials: At discretion of Contractor.
- B. Lumber Forms:
 - 1. Application: Use for edge forms and unexposed finish concrete.
 - 2. Boards: 6 inches or 8 inches in width, shiplapped or tongue and groove, "Standard" Grade Douglas Fir, conforming to WCLIB Standard Grading Rules for West Coast Lumber. Surface boards on four sides.
- C. Plywood Forms:
 - 1. Application: Use for exposed finish concrete.
 - 2. Forms: Conform to PS 1; full size 4 x 8 feet panels; each panel labeled with grade trademark of APA/EWA.
 - 3. Plywood for Surfaces to Receive Membrane Waterproofing: Minimum of 5/8 inch thick; APA/EWA "B-B Plyform Structural I Exterior" grade.
 - 4. Plywood where "Smooth Finish" is required, as indicated on Drawings: APA/EWA "HD Overlay Plyform Structural I Exterior" grade, minimum of 3/4 inch thick.

2.2 PREFABRICATED FORMS

- A. Furnish materials in accordance with NJDOT Standards.
- B. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- C. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

D. Tubular Column Type: Round, spirally wound laminated fiber, wood, or glass fiber material, surface treated with release agent, non-reusable, sizes as indicated on Drawings.

1. Substitutions: Section 01 60 00 - Product Requirements.

E. Steel Forms: Sheet steel, suitably reinforced, and designed for particular use indicated on Drawings.

F. Form Liners: Smooth, durable, grainless and non-staining hardboard, unless otherwise indicated on Drawings.

G. Framing, Studding and Bracing: Stud or No. 3 structural light framing grade.

2.3 FORMWORK ACCESSORIES

A. Form Ties: Removable or Snap-off type, galvanized metal, free of defects capable of leaving holes larger than 1 inch in concrete surface.

B. Spreaders: Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete face. Wire ties, wood spreaders or through bolts are not permitted.

C. Form Anchors and Hangers:

1. Do not use anchors and hangers exposed concrete leaving exposed metal at concrete surface.
2. Symmetrically arrange hangers supporting forms from structural steel members to minimize twisting or rotation of member.
3. Penetration of structural steel members is not permitted.

D. Form Release Agent: Colorless mineral oil that will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

E. Bituminous Joint Filler: ASTM D1751.

F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength and character to maintain formwork in place while placing concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.

C. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.

3.2 INSTALLATION

A. Earth Forms:

1. Earth forms are only permitted is authorized by the Engineer

2. Trench earth forms neatly, accurately, and at least 2 inches wider than footing widths indicated on Drawings.
 3. Trim sides and bottom of earth forms.
 4. Construct wood edge strips at top of each side of trench to secure reinforcing and prevent trench from sloughing.
 5. Form sides of footings where earth sloughs.
 6. Tamp earth forms firm and clean forms of debris and loose material before depositing concrete.
- B. Formwork - General:
1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
 2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
 3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
 4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
 5. Complete wedging and bracing before placing concrete.
- C. Forms for Smooth Finish Concrete:
1. Use steel, plywood or lined board forms.
 2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
 3. Install form lining with close-fitting square joints between separate sheets without springing into place.
 4. Use full size sheets of form lines and plywood wherever possible.
 5. Tape joints to prevent protrusions in concrete.
 6. Use care in forming and stripping wood forms to protect corners and edges.
 7. Level and continue horizontal joints.
 8. Keep wood forms wet until stripped.
- D. Framing, Studding and Bracing:
1. Space studs at 16 inches on center maximum for boards and 12 inches on center maximum for plywood.
 2. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
 3. Construct beam soffits of material minimum of 2 inches thick.
 4. Distribute bracing loads over base area on which bracing is erected.
 5. When placed on ground, protect against undermining, settlement or accidental impact.
- E. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301, ACI 318.
- F. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- G. Obtain Architect/Engineer's approval before framing openings in structural members not indicated on Drawings.
- H. Do not patch formwork.

3.3 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.
- D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer's specifications. Do not coat forms for concrete indicated to receive "scored finish". Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Install formed openings for items to be embedded in or passing through concrete work.
- B. Locate and set in place items required to be cast directly into concrete.
- C. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
- D. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.
- G. Form Ties:
 - 1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
 - 2. Place ties at least 1 inch away from finished surface of concrete.
 - 3. Leave inner rods in concrete when forms are stripped.
 - 4. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.
- H. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.
- I. Construction Joints:
 - 1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
 - 2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
 - 3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
 - 4. Arrange joints in continuous line straight, true and sharp.
- J. Embedded Items:

1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
2. Do not embed wood or uncoated aluminum in concrete.
3. Obtain installation and setting information for embedded items furnished under other Specification sections.
4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.

K. Openings for Items Passing Through Concrete:

1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
2. Coordinate work to avoid cutting and patching of concrete after placement.
3. Perform cutting and repairing of concrete required as result of failure to provide required openings.

L. Screeds:

1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
2. Slope slabs to drain where required or as shown on Drawings.
3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.

M. Screenshot Supports:

1. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad or base type screed supports which will not puncture membrane.
2. Staking through membrane is not permitted.

N. Cleanouts and Access Panels:

1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.5 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
- D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.6 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by Architect/Engineer.

- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.
- D. Leave forms in place for minimum number of days as specified in ACI 347.

3.7 ERECTION TOLERANCES

- A. Tolerances: Construct formwork to produce completed concrete surfaces within construction tolerances specified in ACI 117.

3.8 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements, 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.
- C. Notify Architect/Engineer after placement of reinforcing steel in forms, but prior to placing concrete.
- D. Coordinate inspection of formwork with Township Engineer.
- E. Schedule concrete placement to permit formwork inspection before placing concrete.

END OF SECTION

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SECTION 03 20 00

CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Reinforcing bars.
2. Welded wire fabric.
3. Reinforcement accessories.

B. Related Sections:

1. Section 03 10 00 - Concrete Forming and Accessories.
2. Section 03 30 00 - Cast-In-Place Concrete.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT – NOT USED

1.3 REFERENCES

A. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 318 - Building Code Requirements for Structural Concrete.
3. ACI 530.1 - Specifications for Masonry Structures.
4. ACI SP-66 - ACI Detailing Manual.

B. ASTM International:

1. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
3. A185/A185M-07 Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
4. ASTM A496/A496M - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
5. ASTM A497/A497M - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
6. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
7. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
8. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
9. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
10. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
11. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
12. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.

- C. American Welding Society:
 - 1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.
- D. Concrete Reinforcing Steel Institute:
 - 1. CRSI - Manual of Standard Practice.
 - 2. CRSI - Placing Reinforcing Bars.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices.
- C. Certificates: Submit AWS qualification certificate for welders employed on the Work.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301, ACI 318.
- B. Prepare shop drawings in accordance with ACI SP-66.

1.6 QUALIFICATIONS

- A. Welders: AWS qualified within previous 12 months.

1.7 COORDINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate with placement of formwork, formed openings and other Work.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

- A. Plain Reinforcement: ASTM A706/A706M; 60 ksi yield strength, steel bars, epoxy coated finish.
- B. Welded Plain Wire Fabric: ASTM A185/A185M; in flat sheets, unfinished.

2.2 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage annealed type
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions
- C. Epoxy Coating Patching Material: Type as recommended by coating manufacturer.

2.3 FABRICATION

- A. Fabricate concrete reinforcement in accordance with ACI 318.
- B. Form standard hooks for as indicated on Shop Drawings.
- C. Form reinforcement bends with minimum diameters in accordance with ACI 318.
- D. Fabricate column reinforcement with offset bends at reinforcement splices.
- E. Form spiral column reinforcement from minimum 3/8 inch diameter continuous plain bar or wire.
- F. Form ties and stirrups from the following:
 - 1. For bars No. 10 and Smaller: No. 3 deformed bars.
- G. Weld reinforcement in accordance with AWS D1.4.

2.4 SHOP FINISHING

- A. Epoxy Coated Finish for Steel Bars: ASTM A775/A775M.

2.5 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.
- B. When fabricator is approved by authority having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
 - 1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position beyond specified tolerance.
 - 1. Do not weld crossing reinforcement bars for assembly except as permitted by Architect/Engineer.
- B. Do not displace or damage vapor retarder.
- C. Accommodate placement of formed openings.
- D. Space reinforcement bars with minimum clear spacing in accordance with ACI 318
 - 1. Where bars are indicated in multiple layers, place upper bars directly above lower bars.
- E. Maintain concrete cover around reinforcement in accordance with ACI 318:

Reinforcement Location		Minimum Concrete Cover
Footings and Concrete Formed Against Earth		3 inches
Concrete exposed to earth or weather	No. 6 bars and larger	2 inches
	No. 5 bars and smaller	1-1/2 inches
Supported Slabs, Walls, and Joists	No. 14 bars and larger	1-1/2 inches
	No. 11 bars and smaller	3/4 inches
Beams and Columns		1-1/2 inches
Shell and Folded Plate Members	No. 6 bars and larger	3/4 inches
	No. 5 bars and smaller	1/2 inches

3.2 ERECTION TOLERANCES

- A. Install reinforcement within the following tolerances for flexural members, walls, and compression members:

Reinforcement Depth	Depth Tolerance	Concrete Cover Tolerance
Greater than 8 inches	plus or minus 3/8 inch	minus 3/8 inch
Less than 8 inches	plus or minus 1/2 inch	minus 1/2 inch

- B. Install reinforcement within the tolerances specified in ACI 530.1 for foundation walls.

3.3 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements, 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Field inspection and testing will be performed by Owner's testing laboratory in accordance with ACI 318.
- C. Provide free access to Work and cooperate with appointed firm.
- D. Reinforcement Inspection:
1. Placement Acceptance: Specified, and ACI 318, material requirements and specified placement tolerances.
 2. Welding: Inspect welds in accordance with AWS D1.1.

3. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete for the following:

1. Slabs on grade.
2. Equipment pads.
3. Light pole base.
4. Sidewalks and Curbs
5. Fence Foundations
6. Sign Foundations

B. Related Sections:

1. Section 03 10 00 - Concrete Forming and Accessories:
2. Section 03 20 00 - Concrete Reinforcing.
3. Section 03 39 00 - Concrete Curing.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT – NOT USED

1.3 REFERENCES

A. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 305 - Hot Weather Concreting.
3. ACI 306.1 - Standard Specification for Cold Weather Concreting.
4. ACI 308.1 - Standard Specification for Curing Concrete.
5. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM International:

1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
2. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
3. ASTM C33 - Standard Specification for Concrete Aggregates.
4. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
5. ASTM C42/C42M - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
6. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
7. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
8. ASTM C150 - Standard Specification for Portland Cement.
9. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
10. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
11. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
12. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
13. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
14. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.

15. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
16. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
17. ASTM C685/C685M - Standard Specification for Concrete Made By Volumetric Batching and Continuous Mixing.
18. ASTM C845 - Standard Specification for Expansive Hydraulic Cement.
19. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
20. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
21. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
22. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
23. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
24. ASTM C1157 - Standard Performance Specification for Hydraulic Cement.
25. ASTM C1218/C1218M - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
26. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
27. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
28. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
29. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
30. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
31. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
32. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
33. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
34. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

C. NJDOT Standard Specifications for Road and Bridge Construction, 2007

1.4 SUBMITTALS

A. Design Data:

1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
 - a. Hot and cold weather concrete work.
 - b. Air entrained concrete work.
2. Identify mix ingredients and proportions, including admixtures.
3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

B. Manufacturer's Installation Instructions: Submit installation procedures and interface required with adjacent Work.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301.
- B. Conform to ACI 305 when concreting during hot weather.
- C. Conform to ACI 306.1 when concreting during cold weather.
- D. Acquire cement and aggregate from one source for Work.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with NJDOT and Township of Berkeley Heights standards.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Maintain concrete temperature after installation at minimum 50 degrees F for minimum 7 days.
- B. Maintain high early strength concrete temperature after installation at minimum 50 degrees F for minimum 3 days.

1.9 COORDINATION

- A. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I – Normal;
- B. Furnish in accordance with NJDOT Standards

2.2 ADMIXTURES

- A. Furnish materials in accordance with NJDOT and Township of Berkeley Heights standards.
- B. Air Entrainment: ASTM C260.
- C. Chemical: ASTM C494/C494M.

2.3 ACCESSORIES

- A. Bonding Agent: Not Used
- B. Non-Shrink Grout: ASTM C1107; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days

2.4 JOINT DEVICES AND FILLER MATERIALS

- A. Joint Filler Type A: ASTM D1751;ASTM D994; Asphalt impregnated fiberboard or felt, 1/2 inch thick; tongue and groove profile;

2.5 CONCRETE MIX

- A. Provide concrete in accordance with NJDOT to the following criteria:

Material and Property	Measurement
Compressive Strength (28 day)	4,000 psi

- B. Admixtures: Include admixture types and quantities indicated in concrete mix designs only when approved by Architect/Engineer.
 - 1. Use accelerating admixtures in cold weather. Use of admixtures will not relax cold weather placement requirements.
 - 2. Do not use calcium chloride nor admixtures containing calcium chloride.
 - 3. Use set retarding admixtures during hot weather.
 - 4. Add air entrainment admixture to concrete mix for work exposed to freezing and thawing
- C. Ready Mixed Concrete: Mix and deliver concrete in accordance with ASTM C94, ASTM C685.
- D. Site Mixed Concrete: Mix concrete in accordance with ACI 318.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify requirements for concrete cover over reinforcement.
- B. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Remove laitance, coatings, and unsound materials.
- B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.
- C. Remove debris and ice from formwork, reinforcement, and concrete substrates.
- D. Remove water from areas receiving concrete before concrete is placed.

3.3 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301, ACI 318.
- B. Notify testing laboratory and Architect/Engineer minimum 24 hours prior to commencement of operations.

- C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement.
- D. Separate slabs on grade from vertical surfaces with 1/2 inch thick joint filler.
- E. Place joint filler in slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- F. Extend joint filler from bottom of slab to within 1/4 inch of finished slab surface.
- G. Install construction joint devices in coordination with slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- H. Apply sealants in joint devices. Deposit concrete at final position. Prevent segregation of mix.
- I. Place concrete in continuous operation for each panel or section determined by predetermined joints.
- J. Consolidate concrete.
- K. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- L. Place concrete continuously between predetermined expansion, control, and construction joints.
- M. Do not interrupt successive placement; do not permit cold joints to occur.
- N. Saw cut joints within 12 hours after placing. Use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.
- O. Screed exterior slabs on grade level, maintaining surface flatness of minimum 1/4 inch in 1 ft.

3.4 CONCRETE FINISHING

- A. Provide formed horizontal concrete surfaces to be left exposed with broomed, non-slip finish.
- B. Provide formed vertical surfaces with a hand-rubbed, brushed finish.

3.5 CURING AND PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
 - 1. Protect concrete footings from freezing for minimum 5 days.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.6 FIELD QUALITY CONTROL

- A. Owner will provide field inspection and testing
- B. Provide free access to Work and cooperate with appointed firm.

- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.
- D. Concrete Inspections:
 - 1. Continuous Placement Inspection: Inspect for proper installation procedures.
 - 2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.
- E. Strength Test Samples:
 - 1. Sampling Procedures: ASTM C172.
- F. Field Testing:
 - 1. Slump Test Method: ASTM C143/C143M.
 - 2. Air Content Test Method: [ASTM C173/C173M] [ASTM C231].
 - 3. Temperature Test Method: ASTM C1064/C1064M.
 - 4. Measure slump and temperature for each compressive strength concrete sample.
 - 5. Measure air content in air entrained concrete for each compressive strength concrete sample.

3.7 PATCHING

- A. Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.
- B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.
- C. Patch imperfections as directed by Architect/Engineer in accordance with ACI 301; ACI 318

3.8 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Repair or replacement of defective concrete will be determined by Architect/Engineer.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

END OF SECTION

SECTION 042516 – THIN MASONRY VENEER PANEL SYSTEM

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. Thin brick.
 - 2. Mortar.
 - 3. Cleaning
 - 4. Embedded flashing.
 - 5. Expansion and control joints
 - 6. Fasteners

1.3 REFERENCES

- A. ASTM A 240 – Standard Specifications for Chromium and Chromium Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for general applications.
- B. ASTM A 653 – Standard Specifications for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the hot dip process.
- C. ASTM C 67 – Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
- D. ASTM C 270 – Standard Specification for Mortar for Unit Masonry
- E. ASTM C 1088 – Standard Specification for Thin Veneer Brick Units made from Clay or Shale

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Shop Drawings:
 - 1. Indicate masonry layout, patterns, color arrangement, perimeter conditions, shape requirements, junctions with dissimilar materials, connections, and other related components
 - 2. Locate and detail expansion and control joints.

- C. Samples for Initial Selection:
 - 1. Thin brick.
 - 2. Mortar.

1.5 QUALITY ASSURANCE

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 unless modified by requirements in the Contract Documents.
- B. Comply with all applicable codes, regulations, and standards. Where provision of applicable codes, regulations, and standards conflict with requirements of this section, the more stringent shall govern.
- C. Manufacturer Qualifications:
 - 1. Obtain materials from one manufacturer to ensure compatibility.
 - 2. Metal Panel:
 - a. A history of corporate experience with metal supported unit masonry panels.
 - b. Documented qualifications and capabilities that fully describe the ability to provide the required metal panel system and technical support to the Owner.
- D. Installer Qualifications:
 - 1. Authorized installer or proof of minimum of 5 years experience with a related thin masonry support panel system.
 - 2. At least one supervisor journeyman who shall be present at all times during execution of work, who shall be thoroughly familiar with design requirements, type of materials installed, reference standards and other requirements.
- E. Material Certificates: Prior to delivery, submit certificates indicating compliance with the applicable specifications for Thin Brick Grades, Types or Classes included in these specifications.
- F. Thin Brick test Reports: Submit test reports substantiating compliance with requirements: Sample and test in accordance with ASTM C 67.
 - 1. Testing and reports shall be completed by an independent laboratory.
 - a. Test reports for each type of brick shall be submitted to the Architect for review.
 - b. Thin Brick test reports shall indicate:
 - 1) 2-hour cold water absorption
 - 2) 5-hour boil absorption
 - 3) Saturation coefficient
 - 4) Initial rate of absorption
 - 5) Efflorescence

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's unopened containers, identified with name, brand, type, and grade.
- B. Store products in manufacturer's unopened packaging until ready for installation.

- C. Store panels and accessories off the ground to prevent contamination by mud, dust or other materials likely to cause staining or other defects.
- D. Protect materials from contamination, dampness, freezing, or overheating in accordance with manufacturer's instructions.
- E. Store different types of materials separately.
- F. Mastic and mortar additive are to be stored above 32 degrees and below 86 degrees Fahrenheit.
- G. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 FIELD CONDITIONS

- A. Comply with requirements of referenced standards and recommendations of material manufacturers for environmental conditions before, during, and after installation.
- B. Protection of Work:
 - 1. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimal results. Do not install products under environmental conditions outside manufacturer's absolute limits.
 - 2. Stain Prevention:
 - a. Prevent adhesive, and mortar from staining the face of masonry.
 - b. Remove immediately grout or mortar in contact with face of masonry.
 - c. To avoid smearing of adhesive on the face of masonry, allow adhesive on face of installed masonry to set before trying to remove.
 - d. Protect the wall from rain splashed mud and mortar splatter.
 - e. Turn scaffold boards closest to the wall on edge when work is not in progress to prevent rain from splashing mortar and dirt onto masonry.
- C. Cold-Weather Requirements:
 - 1. Do not use frozen materials or materials mixed or coated with ice or frost.
 - 2. Do not build on frozen substrates.
 - 3. Remove and replace unit masonry damaged by frost or by freezing conditions.
 - 4. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
 - 5. Comply with adhesive manufacturer's application and temperature requirements.
- D. Hot-Weather Requirements:
 - 1. Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
 - 2. Protect mortar from uneven and excessive evaporation.
 - a. The face of the installed thin brick may be dampened with water prior to mortar installation to reduce the absorption of moisture from the mortar joint and increase bond.
 - b. Veneer may be fogged with water to allow the mortar enough time to set. Apply only enough moisture to consistently dampen the wall without allowing water to run down the face.
 - 3. Comply with adhesive manufacturer's application and temperature requirements.

PART 2 - PRODUCTS

2.1 METAL MASONRY SUPPORT PANEL

- A. Metal Masonry Support Panel intended for the exterior structural mechanical support of thin veneer on metal frame construction. 26-gauge architectural grade steel with G90 galvanized thermal set coating and stucco embossed texture with angle support ties.
- B. All metal panels for Thin Brick support shall be coordinated with manufacturer for the system specified.
 - 1. Flat panels: 16 square foot masonry support panels for flat wall areas 48"x48" nominal, shall have support spacing as follows:
 - a. 2-5/8" for modular, standard, and other 2-1/4" high units
- C. Pre-Bent corner panels: 16 sq. ft. masonry support panels for external corner applications 48" high with 16" leg and 32" leg.
 - 1. Support spacing to match flat panels above.

2.2 UNIT MASONRY, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work.

2.3 CLAY MASONRY UNITS

- A. General: Provide shapes indicated and as follows:
 - 1. Provide special shapes for applications where flats (stretcher units) cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels. Mitered units shall not be used at standard corners.
 - 2. Provide special shapes for applications requiring thin brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 - 3. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Product requirements:
 - 1. Refer to drawings for Basis of Design product.
 - 2. Thin Brick: ASTM C 1088, Grade exterior.
 - 3. Modular size: 2-1/4" high, 7-5/8" long
 - 4. Thickness: 3/4"

2.4 MORTAR MATERIALS

- A. Mortar for thin brick:
 - 1. Mortar shall conform to ASTM C 270 Standard Specification for Mortar for Unit Masonry under the guidelines provided in BIA Technical Notes #8 Series.
 - a. Type S

- B. Cold weather additives (including accelerators) shall not be used in thin brick mortar mix.

2.5 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing:
 - 1. Manufacturer standard starter angle: Galvanized steel sheet ASTM A 653 0.024" (26-gauge), minimum ASTM A 925 G-90 coating, pre-bent in 10' lengths.
- B. Flexible Flashing:
 - 1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040".
 - 2. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard product or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.6 CONTROL AND EXPANSION JOINTS

- A. Backer Rod: Non-gassing polyethylene or flexible polyurethane foam rod 25% wider than width of joint to be filled.

2.7 FASTENERS

- A. Screw fasteners shall be a minimum #8, 0.164" shank diameter with a wafer head and corrosion resistance provided by zinc plating with a minimum protection of 800 hours when tested according to ASTM B 117.
- B. Fastener length:
 - 1. Self tapping/self drilling fasteners shall penetrate a minimum 1/4", or not less than three exposed threads behind the stud flange, girt or purlin.

2.8 ADHESIVE

- A. High strength mastics must exceed ASTM D3498 and ASTM C557 specifications with less than 70 grams of VOC per liter with a shear value between the thin veneer and the panel greater than 100 PSI.

2.9 SHEATHING

- A. Provide sheathing as specified in Section 061600.
- B. Sheathing shall meet the following conditions:
 - 1. Exterior grade glass mat gypsum sheathing or exterior grade plywood not less than 1/2" in thickness.

2.10 WEATHER BARRIERS

- A. Provide weather barriers as designated on drawings and in Division 7.

2.11 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
- B. Basis of Design:
 - 1. Diedrich Technologies, Inc. – 202 New Masonry Detergent

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Do not begin installation until substrates and foundations, as well as rough-in and built-in construction have been properly prepared.
 - 1. Walls must be structurally sound and substrate system designed with a wall deflection not greater than L/360.
 - a. Minimum 0.043" (18 gauge) studs for exterior walls
- B. Verify substrate as well as sheathing and weather barrier are properly installed.
- C. Verify walls are plumb and corners are braced to specifications.
- D. Substrate must be flat, within 1/8" within any 4' square area with no planar irregularities greater than 1/4" per 10 lin. Ft.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation. All surfaces must be free of water, snow, dirt, mud, oil and other foreign materials prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under project conditions.
- C. Trim or flash in place per manufacturer's details and/or BIA Technical Note 7A on flashing of Brick Walls

3.3 INSTALLATION, GENERAL

- A. Install materials in accordance with manufacturer's instructions.
- B. Select and arrange exposed masonry units to produce a uniform blend of color and texture. Mix units from several pallets or cubes as they are placed.
- C. Comply with tolerances in TMS 602/ACI 530.1/ASCE 6.

3.4 SUPPORT TIE LEDGE PANEL

- A. Install in accordance with manufacturer's written instructions as applicable to each type of substrate required.
- B. Trim, starter angle and flashing shall be installed prior to panel installation.
- C. Walls shall be constructed of structurally sound studs with an approved building sheathing and weather resistant barriers as required.
- D. Panels shall be clean, free of dirt, oil or any other foreign contaminant.
- E. Lay out panels in advance for accurate spacing of tabs to allow installation of full height masonry units at the top and bottom of walls.
- F. Attach panels flat to the substrate in true and level rows with support ties aligned and level to each other at flat sections as well as corners.
- G. Stagger metal panel joints over sheathing joints. This requires cutting ½ panels when starting at outside or inside corners. When using pre-bent corner panels, stagger joints of flat panels after corner panel installation.
- H. Do not allow panels to bridge movement joints in substrate.
- I. Install full-size uncut panels when possible. When cutting is required to provide staggered panel joints or to fit specific application, cut panels to provide clean, unbent edges.
- J. Install panels to ensure a 1/16" to 1/8" gap between the sides of the panels and butt panels vertically, always leaving a gap at movement joints locations equal to the thickness of the joint.
- K. Stop panel ¼" to 3/8" from inside corners, openings and other materials to allow for movement.
- L. Fastener installation: Mechanically attach metal panels with a minimum of one fastener per sq. ft. increasing spacing along top and bottom of wall and around openings.
 - 1. Horizontal fastener spacing shall not exceed 24"; vertical fastener spacing shall not exceed 16".
 - 2. Provide additional anchors around the perimeter of walls as well as openings larger than 24" in either dimension, as well as building corners not utilizing corner panels as follows:
 - a. Install fasteners a minimum of 3 per sq. ft.
 - 1) At the top and bottom of the walls, fasteners shall be spaced a maximum of 12" horizontally and within the height of a single row or course of masonry.

- 2) At vertical wall ends of walls and openings, fasteners shall be spaced a maximum of 8” vertically within 4” of the end of the panel.

3.5 FASTENERS FOR SUPPORT TIE LEDGE PANEL

- A. Attach fasteners to the framing through the sheathing.
- B. Fasteners shall penetrate steel studs a minimum of ¼” with not less than three exposed threads behind the steel members.

3.6 THIN VENEERS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate locations of openings, movement joints, returns, and offsets..
 1. Avoid using less-than-half-size units, particularly at corners and jambs.
 2. Ensure unfinished or cut faces are not exposed to view upon completion.
- B. Select and arrange units for exposed unit masonry to produce a uniform blend of color and texture.
- C. Lay masonry in bond pattern as indicated on drawings.
- D. Back face of thin brick must be clean and dry; free of dirt, oil or any other foreign contaminant.
- E. Leave a uniform 3/8” to ½” gap at openings to allow for movement joint installation.
- F. Adhere individual units to panel using specified adhesive placed on the back of the units in two ½” to ¾” dabs or vertical strips 3/8” wide. For corner brick apply one dab on head and one dab at each end of the long leg.
 1. Do not apply adhesive in a manner that would create horizontal strips of adhesive that may prevent moisture from draining down the wall.
 2. Do not use excessive adhesives as this will cause thin brick to tilt away from wall prior to adhesive set.
- G. Thin veneers shall be applied within 5 to 10 minutes after adhesive has been applied and before film begins to form on the adhesive.
- H. Space thin brick to ensure that the head joints do not exceed 5/8” or fall below ¼”.
- I. When adjustment is necessary to be made after adhesive begins to harden, remove hardened adhesive and replace with fresh adhesive.
- J. Keep areas intended to receive sealant clean of thin brick, adhesives and other materials during construction.
- K. Do not allow masonry units to bridge movement joints in substrate.

3.7 MORTAR INSTALLATION AND JOINTING

- A. After adhesive has set a minimum of 12 hours, completely fill head and bed joints between adhered veneer intended to receive mortar.
- B. Keep weep holes free from mortar every 24” immediately above starter angles and flashing.
- C. When pointing, completely remove mortar, and refill solidly with pointing mortar, and tool joints.
- D. Tool exposed joints when thumbprint hard to joint profile below:
 - 1. Joint Profile: Tool mortar joint to concave appearance.

3.8 FLASHING

- A. Install embedded flashing and weep holes in wall panel assemblies at the base of the wall, above openings, above horizontal movement joints and other obstructions to downward flow of water, and where indicated.
- B. Before covering with wall panel or mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
- C. Carry flashing vertically as detailed, but not less than 3” above horizontal plane.
- D. Lap flashing a minimum of 3”.
- E. Seal all flashing laps with compatible lap cement.
- F. Extend head and sill flashings not less than 6” beyond edges of openings; seal with mastic.
- G. Project starter angle from face of wall approximately ¼” to form a drip.

3.9 CONTROL AND EXPANSION JOINTS

- A. Keep clean of all mortar, adhesive and debris.
- B. Locate joints where indicated on drawings.
- C. Provide vertical and horizontal pressure-relieving joints where indicated by installing sealant, and inserting a compressible filler when required, as specified in Division 7, but not less than 3/8”. Backer rod may not be required and is dependent upon depth of joint.
- D. Install joints between Thin Brick wall assembly and other materials.
- E. Install joints at changes in substrate and where movement joints occur in substrate.

3.10 CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove adhesive as well as mortar fins and smears before tooling joints.

- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Cut out all defective mortar joints and holes in exposed masonry and provide new mortar.
 - 2. Clean preselected sample area with specified cleaning solution as per manufacturer's recommendations. Do not proceed with cleaning until approved by Architect.
 - 3. Clean thin brick in accordance with manufacturer's written instructions.
 - 4. Protect adjacent surfaces from contact with cleaner.
 - 5. All cleaning practices and products used shall be in accordance with cleaning products manufacturer's written instructions.

END OF SECTION 042516

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Exterior non-load-bearing wall framing.
 - 2. Load-bearing wall framing.
 - 3. Exterior Canopy framing and connection to building.
 - 4. Ceiling joist framing.
 - 5. All required box beam headers.
- B. Related Sections include the following:
 - 1. Division 5 Section "Metal Fabrications" for masonry shelf angles and connections.
 - 2. Division 9 Section "Gypsum Board Assemblies" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated.
 - 2. Deflection Limits: Unless noted otherwise on Structural Drawings, design framing systems to withstand design loads without deflections greater than the following:
 - a. Exterior Wall Framing (Load-Bearing and Non Load-Bearing): Horizontal deflection of 1/600 of the wall height.
 - b. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft.
 - c. Roof Framing: Horizontal deflection of 1/360 of the horizontally projected span.
 - d. Ceiling Joist Framing: Vertical deflection of 1/360 of the span.
 - 3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 - 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 3/4 inch.

- B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
 - 2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.4 SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - 1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding certificates.
- D. Qualification Data: For professional engineer.
- E. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.
 - 5. Vertical deflection clips.
 - 6. Horizontal drift deflection clips
 - 7. Miscellaneous structural clips and accessories.
- F. Research/Evaluation Reports: For cold-formed metal framing.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data.
- B. Professional Engineer Qualifications: A professional engineer who is licensed in the State of New Jersey and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.

- D. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- F. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- G. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
- B. 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:
 - 1. Dietrich Metal Framing; a Worthington Industries Company.
 - 2. MarinoWare; a division of Ware Industries.

2.2 MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - 1. Grade: As required by structural performance.
 - 2. Coating: G60.
- B. Steel Sheet for Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: 50, Class 1 or 2 min. Modify if required by structural performance.

2. Coating: G90.

2.3 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 0.0538 inch.
 2. Minimum Flange Width: 1-5/8 inches
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
 1. Minimum Base-Metal Thickness: Matching steel studs.
 2. Minimum Flange Width: 1-1/4 inches.
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, punched, with stiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 0.0538 inch.
 2. Minimum Flange Width: 1-5/8 inches.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 0.0428 inch.
 2. Minimum Flange Width: 1-5/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: Matching steel studs.
 2. Minimum Flange Width: 1-1/4 inches.
- C. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 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. Dietrich Metal Framing; a Worthington Industries Company.
 - b. MarinoWare, a division of Ware Industries.
- D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0538 inch.
 - b. Flange Width: 1 inch plus twice the design gap.
 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0538 inch.

- b. Flange Width: Outer deflection track flange width plus 1 inch.
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.5 CEILING JOIST FRAMING

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with enlarged service holes, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0428 inch.
 - 2. Flange Width: 1-5/8 inches, minimum.

2.6 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. Anchor clips.
 - 5. End clips.
 - 6. Foundation clips.
 - 7. Gusset plates.
 - 8. Stud kickers, knee braces, and girts.
 - 9. Joist hangers and end closures.
 - 10. Hole reinforcing plates.
 - 11. Backer plates.

2.7 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 55, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.8 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.9 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
 - 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 1. Cut framing members by sawing or shearing; do not torch cut.

2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation, specified in Division 7 Section "Building Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
 1. Anchor Spacing: To match stud spacing.
- B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
 1. Stud Spacing: 16 inches maximum.
 2. Install additional studs as required to align with fiber cement panel joints as described on Drawings.
 3. Triple up studs at all canopy connections to building.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

- E. Align roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
 - 2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced as indicated on Shop Drawings. Fasten at each stud intersection.
- J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: 16 inches.
 - 2. Install additional studs as required to align with fiber cement panel joints as described on Drawings.
 - 3. Triple up studs at all canopy connections to building.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 1. Install double deep-leg deflection tracks and anchor outer track to building structure.
 2. Connect vertical deflection clips to studs and anchor to building structure.
 3. Connect drift clips to cold formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.6 JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
 1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.
- C. Space joists not more than 2 inches from abutting walls, and as follows:
 1. Joist Spacing: 16 inches
- D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.
 1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055213 - PIPE RAILINGS

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. Steel pipe railings.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Railing brackets.
 - 3. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 - 1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 STEEL AND IRON

- A. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
- B. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.4 FASTENERS

- A. General: Provide the following:
 - 1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
 - 2. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.
- D. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Connections: Fabricate railings with welded connections unless otherwise indicated.
- F. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.

4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- G. Close exposed ends of railing members with prefabricated end fittings.
- H. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- J. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.7 STEEL AND IRON FINISHES

- A. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.
- B. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 1. Shop prime uncoated railings with universal shop primer unless otherwise indicated.
- C. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
 1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 2. Set posts plumb within a tolerance of **1/16 inch in 3 feet**.

- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.3 ADJUSTING AND CLEANING

- A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION 055213

SECTION 061000 - ROUGH CARPENTRY

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. Framing with dimension lumber.
 - 2. Framing with timber.
 - 3. Wood blocking, cants, and nailers.
 - 4. Plywood backing panels.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.
- B. Timber: Lumber of 5 inches nominal size or greater in least dimension.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated wood.
 - 2. Fire-retardant-treated wood.
 - 3. Power-driven fasteners.
 - 4. Post-installed anchors.
 - 5. Metal framing anchors.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
 - 3. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
 - 2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Treatment shall not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat items indicated on Drawings, and the following:
 - 1. Concealed blocking.
 - 2. Roof construction.
 - 3. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

- A. Joists, Rafters, and Other Framing Not Listed Above: No. 2 grade.
 - 1. Species:
 - a. Douglas fir-larch; WCLIB or WWPA.

2.5 TIMBER FRAMING

- A. Comply with the following requirements, according to grading rules of grading agency indicated:
 - 1. Species and Grade: Douglas fir-larch, Douglas fir-larch (north), or Douglas fir-south; Select Structural grade; NLGA, WCLIB, or WWPA.
 - 2. Maximum Moisture Content: 20 percent.
 - 3. Additional Restriction: Free of heart centers.

2.6 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Cants.
 - 5. Furring.
 - 6. Grounds.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of the following species:
 - 1. Hem-fir (north); NLGA.
- C. Concealed Boards: 19 percent maximum moisture content and the following species and grades:
 - 1. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.

- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.7 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.8 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 as appropriate for the substrate.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

2.9 METAL FRAMING ANCHORS

- A. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
 - 1. Use for interior locations unless otherwise indicated.
- B. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
 - 1. Use for wood-preservative-treated lumber and where indicated.
- C. Stainless-Steel Sheet: ASTM A 666, Type 304.
 - 1. Use for exterior locations and where indicated.

- D. Joist Hangers: U-shaped joist hangers with 2-inch long seat and 1-1/4-inch wide nailing flanges at least 85 percent of joist depth.
 - 1. Thickness: 0.050 inch.
- E. Bridging: Rigid, V-section, nailless type, 0.050 inch thick, length to suit joist size and spacing.
- F. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.
 - 1. Width: 1-1/4 inches.
 - 2. Thickness: 0.050 inch.
 - 3. Length: 24 inches min.
- G. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.

2.10 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
- C. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.
- E. Install shear wall panels to comply with manufacturer's written instructions.
- F. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

- G. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- H. Do not splice structural members between supports unless otherwise indicated.
- I. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- J. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- K. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- L. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- M. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- N. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
- O. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug, but do not countersink nail heads unless otherwise indicated.

- P. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
 - 1. Comply with approved fastener patterns where applicable.
 - 2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
 - 3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 TIMBER FRAMING INSTALLATION

- A. Install timber beams with crown edge up and provide not less than 4 inches of bearing on supports. Provide continuous members unless otherwise indicated; tie together over supports as indicated if not continuous.
- B. Install wood posts using metal anchors indicated.
- C. Treat ends of timber beams and posts exposed to weather by dipping in water-repellent preservative for 15 minutes.

3.4 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061600 - SHEATHING

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. Wall sheathing.
 - 2. Roof sheathing.
 - 3. Sheathing joint and penetration treatment.
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for plywood backing panels.
 - 2. Section 072500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
 - 3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
 - 4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated plywood.
 - 2. Fire-retardant-treated plywood.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201/D 3201M at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to **170 deg F** shall be not less than span ratings specified.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat all plywood unless otherwise indicated.

2.4 WALL SHEATHING

- A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.
 - 1. Thickness: 5/8 inch thick.
 - 2. Size: 48 by 96 inches for vertical installation.

2.5 ROOF SHEATHING

- A. Plywood Sheathing: Exterior, Structural I sheathing.
 - 1. Nominal Thickness: Not less than **3/4 inch**.

2.6 PARAPET SHEATHING

- A. Plywood Sheathing: Exterior, Structural I sheathing.
 - 1. Nominal Thickness: Not less than 3/4 inch.

2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
 1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.
 2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

2.8 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
 1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 3. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
 - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
- D. Seal sheathing joints according to sheathing manufacturer's written instructions.
 - 1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 - 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.3 CEMENTITIOUS BACKER UNIT INSTALLATION

- A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

END OF SECTION 061600

SECTION 061800 – LAMINATED WOOD DECKING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Includes: furnish and install roof decking with required fasteners in accordance with building codes, manufacturer, and engineering requirements.

1.2 SYSTEM DESCRIPTION

- A. Glue-laminated decking:
 - 1. Species: Douglas fir – Larch
 - 2. Sizes: nominal 4"x6"
 - 3. Appearance Grade: Decorative
 - 4. Lengths: Random between 12'-0" to 24'-0"
 - 5. Pattern: Center matched
 - 6. Face (finish): sanded and factory finished with semi-transparent stain. Color to be selected from full range.
 - 7. Decking Layup: Random length continuous
 - 8. Tongue and Groove: Single
 - 9. Fire Retardant: Apply fire retardant spray – refer to plans for product information
- B. Design:
 - 1. Decking species and size shall satisfy applicable building codes in accordance with decking layup selected.
 - 2. Allowable load determined in accordance with timber decking design formulas in the *Timber Construction Manual*, or other accepted engineering practice.
 - 3. Design values (allowable stresses and modulus of elasticity) to be provided by decking manufacturer.
- C. Fasteners:
 - 1. Face nailing to support members and course to course slant nailing per manufacturer.
- D. References:
 - 1. Timber Construction Manual, American Institute of Timber Construction, 7012 S Revere Parkway, Suite 140, Englewood, CO 80112.
 - 2. National Design Specification for Wood Construction, Special Design Provisions for Wind and Seismic, American Forest and Paper Association / American Wood Council, 111 Nineteenth Street, NW, Suite 800, Washington D.C., 20036.
 - 3. American Wood Council Wood Construction Data 2, Tongue and Groove Roof Decking, American Forest and Paper Association / American Wood Council, 111 Nineteenth Street, NW, Suite 800, Washington D.C., 20036.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated wood complies with requirements. Include physical properties of treated materials.
- B. Shop drawings
 - 1. Provide detailed shop drawings for the project with all required dimensions, layouts, fasteners, etc.

1.4 QUALITY ASSURANCE

- A. Glue Laminated Decking:
 - 1. Lamination lumber stock: Graded to American Softwood Lumber Standard Grading Provisions.
 - 2. Lumber moisture content: 10%-12% average; maximum 15%
 - 3. Lamination adhesive: fully exterior phenolic-resorcinol, in compliance with ASTM D2559.
 - 4. Glue line bonding, lumber grading, and manufacturing certified by the Western Wood Products Association, complying with AITC Standard 200-2004.
 - 5. Lamination Joints: structural finger joints for face and back.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Verify manufacturer, species, size, appearance grade, lengths, pattern, face finish, and end joints.
- B. Storage:
 - 1. Decking units are to be stored on a level area with adequate blocking to avoid warping.
 - 2. Manufacturer wrapping or other water-resistant wrapping should be used on top and sides where stored in uncovered locations. Water resistant wrap should be 'open' at bottom to prevent moisture trapping against decking.
 - 3. Decking must also be separated from ground moisture during storage.
- C. Handling: Decking units and pieces shall not be dropped or dragged and shall be handled in a way to prevent surface, tongue and groove, and other damage.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 SUPPORTING FRAMING

- A. Supporting framing members shall be straight and true and clear of debris and excess moisture.
- B. Layup rules per American Wood Council Wood Construction Data 2.

3.2 DECKING

- A. Decking pieces shall be supported by framing members as prescribed by manufacturer per layup choice.
- B. Pieces damaged on site shall not be used.
- C. Adjoining and adjacent decking pieces shall be tight.
- D. Decking shall not be installed when or where moisture content of pieces exceeds 15%.
- E. Fastener size, type, and locations shall be per manufacturer for non-engineered construction.

3.3 OTHER

- A. Installation of roof decking shall be coordinated with other framing and trades.
- B. Fasteners used for other roof materials shall not fully penetrate decking taking into consideration of shrink-swell decking and other materials.

END OF SECTION 061800

SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

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. Plastic-laminate-faced architectural cabinets.
 - 2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including high-pressure decorative laminate and cabinet hardware and accessories.
 - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show details full size.
 - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 3. Show locations and sizes of cutouts and holes for electrical switches and outlets installed in architectural plastic-laminate cabinets.
 - 4. Apply AWI Quality Certification Program label to Shop Drawings.
- C. Samples for Initial Selection:
 - 1. Plastic laminates.
 - 2. PVC edge material.
 - 3. Thermoset decorative panels.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
- C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.
- C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.

- B. Grade: Custom.
- C. Type of Construction: Frameless.
- D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- E. Reveal Dimension: 1/2 inch.
- F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
- G. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Postformed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade HGS.
 - 4. Edges: Grade HGS.
- H. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
 - a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
 - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
 - 2. Drawer Sides and Backs: Solid-hardwood lumber.
 - 3. Drawer Bottoms: Hardwood plywood.
- I. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- J. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- K. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.
- L. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As selected by Architect from laminate manufacturer's full range in the following categories:
 - a. Solid colors.
 - b. Wood grains.
 - c. Patterns.

2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Wood Moisture Content: 5 to 10 percent.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087111 "Door Hardware (Descriptive Specification)."
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening, self-closing.
- C. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.
- D. Catches: Magnetic catches, BHMA A156.9, B03141.
- E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
- F. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.
- G. Drawer Slides: BHMA A156.9.
 - 1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer; full-extension type; zinc-plated steel with polymer rollers.
 - 2. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
 - 3. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1.
 - 4. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-100.
 - 5. For computer keyboard shelves, provide Grade 1HD-100.
- H. Door Locks: BHMA A156.11, E07121.
- I. Drawer Locks: BHMA A156.11, E07041.
- J. Door and Drawer Silencers: BHMA A156.16, L03011.
- K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
- L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive.

2.5 FABRICATION

- A. Fabricate cabinets to dimensions, profiles, and details indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.
- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.

- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.
 - 1. Use filler matching finish of items being installed.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116

SECTION 072100 - THERMAL INSULATION

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. Extruded polystyrene foam-plastic board.
 - 2. Glass-fiber blanket.
- B. Related Requirements:
 - 1. Section 075323 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" for insulation specified as part of roofing construction.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

- A. Extruded polystyrene boards in this article are also called "XPS boards." Roman numeral designators in ASTM C 578 are assigned in a fixed random sequence, and their numeric order does not reflect increasing strength or other characteristics.
- B. Extruded Polystyrene Board, Type IV: ASTM C 578, Type IV, 25-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.

2.2 GLASS-FIBER BLANKET

- A. Glass-Fiber Blanket, Reinforced-Foil Faced: ASTM C 665, Type III (reflective faced), Class A faced surface with a flame-spread index of 25 or less and Smoke Developed Index of less than 450; Category 1, faced with foil scrim.

2.3 INSULATION FASTENERS

- A. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

2.4 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 - 1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
 - 2. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
- C. Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set board insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.
- B. On horizontal surfaces, loosely lay board insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Anchor Installation: Install board insulation on masonry substrates by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to masonry substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
 - 2. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between masonry substrate and insulation.
 - 3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
 - 4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.
- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.5 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 - 5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
 - 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.6 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072119 - FOAMED-IN-PLACE INSULATION

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. Closed-cell spray polyurethane foam.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM

- A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 1.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.
 - 1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.

2.2 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.
- B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Spray insulation to envelop entire area to be insulated and fill voids.
- C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
- D. Framed Construction: Install into cavities formed by framing members to achieve R value or thickness indicated on Drawings.
- E. Miscellaneous Voids: Apply according to manufacturer's written instructions.

3.3 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION 072119

SECTION 072500 - WEATHER BARRIERS

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. Building wrap.
 2. Flexible flashing.
 3. Drainage material.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.
- B. Shop Drawings: Show details of building wrap at terminations, openings, and penetrations. Show details of flexible flashing applications.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

- A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
 1. Water-Vapor Permeance: Not less than 25 perms per ASTM E 96/E 96M, Desiccant Method (Procedure A).
 2. Air Permeance: Not more than 0.004 cfm/sq. ft. at 0.3-inch wg when tested according to ASTM E 2178.
 3. Allowable UV Exposure Time: Not less than three months.
 4. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

- B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 FLEXIBLE FLASHING

- A. Rubberized-Asphalt Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.040 inch.
 - 1. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.
- B. Primer for Flexible Flashing: Product recommended in writing by flexible flashing manufacturer for substrate.
- C. Nails and Staples: Product recommended in writing by flexible flashing manufacturer and complying with ASTM F 1667.

2.3 DRAINAGE MATERIAL

- A. Drainage Material: Product shall maintain a continuous open space between water-resistive barrier and exterior cladding to create a drainage plane and shall be used under siding.
 - 1. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

- A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.
- B. Cover sheathing with water-resistive barrier as follows:
 - 1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
 - 2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.
- C. Building Wrap: Comply with manufacturer's written instructions and warranty requirements.
 - 1. Seal seams, edges, fasteners, and penetrations with tape.
 - 2. Extend into jambs of openings and seal corners with tape.

3.2 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
 - 1. Prime substrates as recommended by flashing manufacturer.
 - 2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
 - 3. Lap flashing over water-resistive barrier at bottom and sides of openings.
 - 4. Lap water-resistive barrier over flashing at heads of openings.
 - 5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

3.3 DRAINAGE MATERIAL INSTALLATION

- A. Install drainage material over building wrap and flashing to comply with manufacturer's written instructions.

END OF SECTION 072500

SECTION 073113 - ASPHALT SHINGLES

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. Asphalt shingles.
 2. Underlayment.
 3. Metal flashing and trim.

1.3 DEFINITION

- A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 REFERENCES

- A. American Society for Testing and Materials (ASTM) Annual Book of ASTM Standards.
 1. ASTM A 653 – Standard Specification for steel sheet, zinc coated or Zinc-Iron Alloy coated by hot dip process.
 2. ASTM B 209 – Standard Specification for aluminum and aluminum-alloy sheet and plate.
 3. ASTM D 3018 – Standard Specification for Class A asphalt shingles surfaced with mineral granules.
 4. ASTM D 3161 – Standard Test Method for Wind-Resistance of asphalt shingles. (Fan-Induced Method)
 5. ASTM D 7158 – Standard Test Method for Wind-Resistance of sealed asphalt shingles (Uplift Force/Uplift Resistance Method)
- B. Underwriters Laboratories (UL) Roofing Systems and Materials Guide (TGFU R1306).
 1. UL 790 – Tests for Fire Resistance of Roof Covering Materials.
 2. UL 997- Wind Resistance of Prepared Roof Covering Materials.
 3. UL 2218 – Impact Resistance of Prepared Roof Covering Materials.
- C. Asphalt Roofing Manufacturers Association (ARMA)
- D. Sheet Metal and Air Conditioning Contractors National Association, Inc (SMACNA) – Architectural Sheet Metal Manual.

- E. National Roofing Contractors Association (ASCE) – ASCE 7 – Minimum Design Loads for Building and other structures.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.
 - 1. Asphalt Shingles: Full size.
 - 2. Ridge and Hip Cap Shingles: Full size.
 - 3. Exposed Valley Lining: 12 inches square.
- C. Samples for Initial Selection: For each type of asphalt shingle indicated.
 - 1. Include similar Samples of accessories involving color selection.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each type of asphalt shingle and underlayment product indicated, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Sample Warranty: For manufacturer's warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For asphalt shingles to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Asphalt Shingles: 100 sq. ft. of each type, in unbroken bundles.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for all roofing products to be installed under this section.

1.10 REGULATORY REQUIREMENTS

- A. Provide a roofing system achieving a UL Class A fire classification.
- B. Install all roofing products in accordance with all federal, state, and local building codes.
- C. All work shall be performed in a manner consistent with OSHA guidelines.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Store all products in manufacturer's unopened, labeled packaging until they are ready for installation.
- B. Store roofing materials in a covered, well-ventilated area, at temperatures not more than 110 degrees F; do not store near steam pipes, radiators, or in direct sunlight.
- C. Store underlayment rolls on end on pallets or other raised surfaces. Do not double stack rolls.
- D. Protect unused roofing materials from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.
- E. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.
- F. Store and dispose of solvent-based materials in accordance with all federal, state, and local regulations.

1.12 FIELD CONDITIONS

- A. Proceed with work only when the existing and forecasted weather conditions will permit work to be performed in accordance with manufacturer's recommendations.

1.13 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace asphalt shingles that fail within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Manufacturing defects.
 - 2. Material Warranty Period: 20 years from date of Substantial Completion, prorated, with all years nonprorated.
 - 3. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds of up to 110 mph for 15 years from date of Substantial Completion.
 - 4. Algae-Resistance Warranty Period: Asphalt shingles will not discolor for 10 years from date of Substantial Completion.
 - 5. Workmanship Warranty Period: 20 years from date of Substantial Completion.
- B. Roofing Installer's Warranty: On warranty form at end of this Section, signed by Installer, in which Installer agrees to repair or replace components of asphalt-shingle roofing 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 PERFORMANCE REQUIREMENTS

- A. Exterior Fire-Test Exposure: Provide asphalt shingles and related roofing materials identical to those of assemblies tested for Class A fire resistance according to ASTM E 108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

2.2 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Asphalt Shingles: Self-sealing, granule surfaced, asphalt shingle with a strong fiberglass reinforced core and stain protection, which prevents pronounced discoloration from blue-green algae through formulation/unique blends of granules. Architectural laminate styling provides a wood shake appearance with a 5-5/8" exposure. UL 790 Class A rated with UL 997 Wind Resistance Label; ASTM D 1788, Class H; ASTM D 3161, Type 1; ASTM 3018, Type 1; ASTM D 3462; AC438; CSA A123.5-98
 1. Color and Blends: As selected by Architect from manufacturer's full range.
- B. Hip and Ridge Shingles: High profile self-sealing hip and ridge shingle match the color of selected roof shingle.

2.3 STARTER STRIP

- A. Self-sealing starter shingle designed for premium roof shingles.

2.4 UNDERLAYMENT MATERIALS

- A. Self-Adhering Sheet Underlayment, Polyethylene Faced: Minimum of 25-mil thick, slip-resisting, polyethylene-film-reinforced top surface laminated to SBS-modified asphalt adhesive, with release backing; cold applied.
 1. Applied over entire area of sloped roof.
 2. Tensile Strength: 250 psi; ASTM D412 (Die C Method)
 3. Elongation, membrane: 250%; ASTM D412 (Die C Method)
 4. Permeance (Max): 0.05 Perms; ASTM E96
- B. Self-Adhering Sheet Underlayment: Minimum of 40-mil thick; with slip-resisting, polymer-film-reinforced or glass-reinforced top surface laminated to layer of butyl or SBS-modified asphalt adhesive; with release backing; cold applied; and evaluated and documented to be suitable for use for intended purpose under applicable codes by a testing and inspecting agency acceptable to authorities having jurisdiction.
 1. Applied where ice and water shield indicated on plans and 36" around all roof penetrations.
 2. Tensile Strength: 250 psi; ASTM D412 (Die C Method)
 3. Elongation, membrane: 250%; ASTM D412 (Die C Method)
 4. Permeance (Max): 0.05 Perms; ASTM E96

5. Low-Temperature Flexibility: Passes after testing at minus 20 deg F according to ASTM D 1970.

2.5 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
- B. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch diameter, sharp-pointed, with a minimum 3/8-inch diameter flat head and of sufficient length to extend at least 1/8 inch through plywood sheathing.
 1. Shank: Barbed.
 2. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

2.6 METAL FLASHING AND TRIM

- A. General: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
 1. Sheet Metal: Stainless steel.
- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of the item.
 1. Apron Flashings: Fabricate with lower flange a minimum of 5 inches over and 4 inches beyond each side of downslope asphalt shingles and 6 inches up the vertical surface.
 2. Step Flashings: Fabricate with a headlap of 2 inches and a minimum extension of 5 inches over the underlying asphalt shingle and up the vertical surface.
 3. Cricket or Backer Flashings: Fabricate with concealed flange extending a minimum of 24 inches beneath upslope asphalt shingles and 6 inches beyond each side of chimney and 6 inches above the roof plane.
 4. Open-Valley Flashings: Fabricate in lengths not exceeding 10 feet with 1-inch high, inverted-V profile at center of valley and equal flange widths of 12 inches.
 5. Drip Edges: Fabricate in lengths not exceeding 10 feet with 2-inch roof-deck flange and 1-1/2-inch fascia flange with 3/8-inch drip at lower edge.
- C. Vent Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof, and extending at least 4 inches from pipe onto roof.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provisions have been made for flashings and penetrations through asphalt shingles.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
- B. Self-Adhering Sheet Underlayment (ice and water shield): Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install lapped in direction that sheds water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days.
 - 1. Eaves: Extend from edges of eaves 36 inches beyond interior face of exterior wall.
 - 2. Rakes: Extend from edges of rake 36 inches beyond interior face of exterior wall.
 - 3. Valleys: Extend from lowest to highest point 18 inches on each side.
 - 4. Ridges: Extend 36 inches on each side.
 - 5. Sidewalls: Extend beyond sidewall 18 inches, and return vertically against sidewall not less than 4 inches.
 - 6. Chimneys and Other Roof-Penetrating Elements: Extend beyond penetrating element 18 inches, and return vertically against penetrating element not less than 4 inches.
 - 7. Roof Slope Transitions: Extend 18 inches on each roof slope.
- C. Metal-Flashed, Open-Valley Underlayment: Install two layers of minimum 36-inch wide underlayment centered in valley. Stagger end laps between layers at least 72 inches. Lap ends of each layer at least 12 inches in direction to shed water, and seal with asphalt roofing cement. Fasten each layer to roof deck.
 - 1. Lap roof-deck underlayment over first layer of valley underlayment at least 6 inches.

3.3 METAL FLASHING INSTALLATION

- A. General: Install metal flashings and other sheet metal to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
 - 1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."
- B. Apron Flashings: Extend lower flange over and beyond each side of downslope asphalt shingles and up the vertical surface.
- C. Step Flashings: Install with a headlap of 2 inches and extend over the underlying asphalt shingle and up the vertical surface. Fasten to roof deck only.
- D. Cricket or Backer Flashings: Install against the roof-penetrating element extending concealed flange beneath upslope asphalt shingles and beyond each side.
- E. Open-Valley Flashings: Install centered in valleys, lapping ends at least 8 inches in direction to shed water. Fasten upper end of each length to roof deck beneath overlap.
 - 1. Secure hemmed flange edges into metal cleats spaced 12 inches apart and fastened to roof deck.
 - 2. Adhere 9-inch wide strip of self-adhering sheet to metal flanges and to self-adhering sheet underlayment.
- F. Rake Drip Edges: Install rake drip-edge flashings over underlayment and fasten to roof deck.
- G. Eave Drip Edges: Install eave drip-edge flashings below underlayment and fasten to roof sheathing.
- H. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.4 ASPHALT-SHINGLE INSTALLATION

- A. General: Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and recommendations in NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."
- B. Install starter strip along lowest roof edge, consisting of an asphalt-shingle strip at least 7 inches wide with self-sealing strip face up at roof edge.
 - 1. Extend asphalt shingles 3/4 inch over fasciae at eaves and rakes.
 - 2. Install starter strip along rake edge.
- C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- D. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

- E. Install asphalt shingles by single-strip column or racking method, maintaining uniform exposure. Install full-length first course followed by cut second course, repeating alternating pattern in succeeding courses.
- F. Fasten asphalt-shingle strips with a minimum of six roofing nails located according to manufacturer's written instructions.
 - 1. When ambient temperature during installation is below 50 deg F, seal asphalt shingles with asphalt roofing cement spots.
- G. Open Valleys: Cut and fit asphalt shingles at open valleys, trimming upper concealed corners of shingle strips. Maintain uniform width of exposed open valley from highest to lowest point.
 - 1. Set valley edge of asphalt shingles in a 3-inch wide bed of asphalt roofing cement.
 - 2. Do not nail asphalt shingles to metal open-valley flashings.
- H. Hip and Ridge Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.

END OF SECTION 073113

SECTION 074646 - FIBER-CEMENT SIDING

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 fiber-cement siding and soffit.
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
 - 2. Section 072500 "Weather Barriers" for weather-resistive barriers.

1.3 COORDINATION

- A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples for Initial Selection: For fiber-cement siding and soffit including related accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of fiber-cement siding and soffit.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.
- C. Research/Evaluation Reports: For each type of fiber-cement siding required, from ICC-ES.
- D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish full lengths of fiber-cement siding and soffit including related accessories, in a quantity equal to 2 percent of amount installed.

1.8 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.
 - 1. Build mockups for fiber-cement siding and soffit including accessories.
 - a. Size: 48 inches long by 60 inches high.
 - b. Include outside corner on one end of mockup and inside corner on other end.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Approved mockups may not become part of the completed Work.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with labels intact until time of use.
- B. Store materials on elevated platforms, under cover, and in a dry location.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including cracking and deforming.
 - b. Deterioration of materials beyond normal weathering.
 - 2. Warranty Period: 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.2 FIBER-CEMENT SIDING

- A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.

- B. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.
- C. Nominal Thickness: Not less than 5/16 inch.
- D. Horizontal Pattern: Boards 6-1/4 to 6-1/2 inches wide in plain style.
 - 1. Texture: Smooth.
- E. Factory Priming: Manufacturer's standard acrylic primer.

2.3 FIBER-CEMENT SOFFIT

- A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
- B. Nominal Thickness: Not less than 5/16 inch.
- C. Pattern: 16-inch wide sheets with smooth texture.
- D. Factory Finish: Manufacturer's standard finish. Color to be selected from full range.

2.4 ACCESSORIES

- A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.
 - 1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.
- B. Decorative Accessories: Provide the following fiber-cement decorative accessories as indicated:
 - 1. Corner posts.
 - 2. Door and window casings.
 - 3. Fasciae.
- C. Flashing: Provide aluminum flashing complying with Section 076200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.
 - 1. Finish for Aluminum Flashing: High-performance organic finish.
- D. Fasteners:
 - 1. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch, or three screw-threads, into substrate.
 - 2. For fastening fiber cement, use hot-dip galvanized fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement siding and soffit and related accessories.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 - 1. Do not install damaged components.
 - 2. Install fasteners no more than 24 inches o.c.
- B. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074646

SECTION 075423 - THERMOPLASTIC SINGLE-PLY ROOFING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes
 - 1. Thermoplastic Polyolefin Single-Ply Roofing Membrane
 - 2. Insulation

1.02 REFERENCES

- A. Factory Mutual (FM Global) - *Approval Guide*
- B. Underwriters Laboratories (UL) - *Roofing Systems and Materials Guide* (TGFU R1306)
- C. American Society for Testing and Materials (ASTM) - *Annual Book of ASTM Standards*
- D. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - *Architectural Sheet Metal Manual*
- E. National Roofing Contractors Association (NRCA)
- F. American Society of Civil Engineers (ASCE)
- G. U.S. Green Building Council (USGBC)

1.03 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D1079 and the glossary of the National Roofing Contractors Association (NRCA) *Roofing and Waterproofing Manual* for definitions of roofing terms related to this section.

1.04 SUBMITTALS

- A. Product Data: Provide product data sheets for each type of product indicated in this section.
- B. Shop Drawings: Provide manufacturers standard details and approved shop drawings for the roof system specified.
- C. Samples: Provide samples of insulations, fasteners, membrane materials and accessories for verification of quality.
- D. Certificates: Installer shall provide written documentation from the manufacturer of their authorization to install the roof system, and eligibility to obtain the warranty specified in this section.

1.05 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer shall provide a roofing system that meets or exceeds all criteria listed in this section.
- B. Installer's Qualifications:
 - 1. Installer shall be classified as a *Master* contractor as defined and certified by Roofing Manufacturer.
- C. Source Limitations: All components listed in this section shall be provided by a single manufacturer or approved by the primary roofing manufacturer.
- D. Final Inspection
Manufacturer's representative shall provide a comprehensive final inspection after completion of the roof system. All application errors must be addressed and final punch list completed.

1.06 PRE-INSTALLATION CONFERENCE

- A. Prior to scheduled commencement of the roofing installation and associated work, conduct a meeting at the project site with the installer, architect, owner, Roofing Manufacturer representative and any other persons directly involved with the performance of the work. The installer shall record conference discussions to include decisions and agreements reached (or disagreements), and furnish copies of recorded discussions to each attending party. The main purpose of this meeting is to review foreseeable methods and procedures related to roofing work.

1.07 PERFORMANCE REQUIREMENTS

- A. Provide an installed roofing membrane and base flashing system that does not permit the passage of water, and will withstand the design pressures calculated in accordance with the most current revision of ASCE 7.
- B. Manufacturer shall provide all primary roofing materials that are physically and chemically compatible when installed in accordance with manufacturers current application requirements.
- C. Heat Aging:
 - 1. Test Method D573. Age sheet specimens for 150 days at 275°F. After exposure, the specimens shall be removed, wrapped around a 3 inch mandrel, and inspected for cracks and crazing. A specimen is rated "pass" if no cracks or crazing is observed.
- D. Weather Resistance:
 - 1. Test Method G151 and G155, using conditions detailed in ASTM D6878 except that the radiant exposure should be 40,320 kJ/m².nm at 340 nm (i.e. 4 times the D6878 standard). After exposure, the specimens shall be removed, wrapped around a 3 inch mandrel, and inspected for cracks and crazing. A specimen is rated "pass" if no cracks or crazing is observed.

1.08 REGULATORY REQUIREMENTS

- A. All work shall be performed in a safe, professional manner, conforming to all federal, state and local codes.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Deliver all roofing materials to the site in original containers, with factory seals intact.
- B. Store all pail goods in their original undamaged containers in a clean, dry location within their specified temperature range.
- C. Do not expose materials to moisture in any form before, during, or after delivery to the site. Reject delivery of materials that show evidence of contact with moisture.
- D. Remove manufacturer supplied plastic covers from materials provided with such. Use “breathable” type covers such as canvas tarpaulins to allow venting and protection from weather and moisture. Cover and protect materials at the end of each work day. Do not remove any protective tarpaulins until immediately before the material will be installed.
- E. Materials shall be stored above 55°F a minimum of 24 hours prior to application.

1.10 PROJECT CONDITIONS

- A. Weather
 - 1. Proceed with roofing only when existing and forecasted weather conditions permit.
 - 2. Ambient temperatures must be above 45°F when applying hot asphalt or water based adhesives.

1.11 WARRANTY

- A. Provide Manufacturers Guarantee with single source coverage and no monetary limitation where the manufacturer agrees to repair or replace components in the roofing system, which cause a leak due to a failure in materials or workmanship.
 - 1. Duration: Twenty-Five (25) years from the date of completion.
- B. TPO Reflectivity Limited Warranty: Manufacturer warrants to the original building owner, that the TPO white roof membrane will meet or exceed the initial and “aged” ENERGY STAR® reflectivity requirements for low slope roofing membranes (65% initial, 50% aged) when installed and maintained in accordance with Manufacturer’s requirements. The aged reflectivity shall meet or exceed these requirements when measured after cleaning the membrane in accordance with Manufacturer recommendations.

PART 2 - PRODUCTS

2.01 INSULATION

- A. Rigid polyisocyanurate board, with a strong white or black fibrous glass facer conforming to or exceeding the requirements of ASTM C 1289 / FS HH-I-1972.
 - 1. Basis of Design: GAF EnergyGuard™ Polyiso or approved equal.

2. Board Thickness: 2" min.
 3. Thermal Resistance (LTTR value) of: 20 min.
- B. Rigid polyisocyanurate board, with a strong white or black fibrous glass facer conforming to or exceeding the requirements of ASTM C 1289 / FS HH-I-1972.
1. Basis of Design: GAF EnergyGuard™ Tapered Polyiso or approved equal.
 2. Board Thickness: ¼" tapered
 3. Thermal Resistance (LTTR value) of: varies

2.02 MEMBRANE MATERIALS

- A. A fleece back polyester scrim reinforced thermoplastic polyolefin membrane with a nominal 0.060 inch (60 mil) thickness, for use as a single ply roofing membrane. Engineered to provide high solar reflectivity and extremely high UV and thermal resistance. These combined characteristics produce a single-ply membrane suitable for the most demanding solar installations as well as any other high heat or solar loading applications. Meets or exceeds the minimum requirements of ASTM D-6878. UL Listed and FM Approved. Each full roll contains approximately 1000 sq.ft. of roofing material, 10' X 100', weighing 322 lbs.
1. Basis of Design: GAF EverGuard Extreme® TPO 60 mil Fleece Back thermoplastic single-ply roofing membrane or approved equal.

2.03 FLASHING MATERIALS

- A. A smooth type, polyester scrim reinforced thermoplastic polyolefin membrane with a nominal 0.060 inch (60 mil) thickness, for use as a single ply roofing membrane. Engineered to provide high solar reflectivity and extremely high UV and thermal resistance. These combined characteristics produce a single-ply membrane suitable for the most demanding solar installations as well as any other high heat or solar loading applications. Meets or exceeds the minimum requirements of ASTM D-6878. UL Listed and FM Approved. Each full roll contains approximately 1000 sq.ft. of roofing material, 10' X 100', weighing 322 lbs.
1. Basis of Design: GAF EverGuard Extreme® TPO 60 mil thermoplastic single-ply roofing membrane or approved equal.

2.04 ADHESIVES, SEALANTS and PRIMERS

- A. Low VOC solvent-based Bonding Adhesive at flashing: Solvent based rubberized adhesive for use with approved TPO membranes.
1. Basis of Design: GAF EverGuard® Low VOC Bonding Adhesive or approved equal.
- B. Manufacturers approved roofing adhesive for TPO membrane.
1. Basis of Design: GAF® 2 Part Roofing Adhesive or approved equal.
- C. Manufacturers approved roofing adhesive for insulation.
1. Basis of Design: GAF® OlyBond500 Insulation Adhesive or approved equal.
- D. Solvent based liquid, required to protect field cut edges of EverGuard TPO membranes. Applied directly from a squeeze bottle.
1. Basis of Design: GAF EverGuard® TPO Cut Edge Sealant or approved equal.
- E. Low VOC solvent based primer for preparing surfaces to receive butyl based adhesive tapes.
1. Basis of Design: GAF EverGuard® TPO Low VOC Primer or approved equal.

- F. Solvent based seam cleaner used to clean exposed or contaminated seam prior to heat welding.
 - 1. Basis of Design: GAF EverGuard® TPO Seam Cleaner or approved equal.
- G. Low VOC TPO cleaner designed to clean exposed or contaminated seams prior to heat welding to remove any residual soap or revitalize aged membranes. Contains only 50 grams per liter of Volatile Organic Content and has been formulated using a blend of primarily VOC-exempt ingredients to be in compliance with air quality regulations for single ply roofing products.
 - 1. Basis of Design: GAF EverGuard® CleanWeld® Low VOC Cleaner/Conditioner or approved equal.
- H. Solvent based, trowel grade synthetic elastomeric sealant. Durable and UV resistant suitable for use where caulk is typically used. Available in 10 oz. tubes,.
 - 1. Basis of Design: GAF FlexSeal™ Caulk Grade or approved equal.
- I. Commercial grade roofing sealant suitable for sealing the upper lip of exposed termination bars and penetrations and around clamping rings and comes with a 20 yr ltd warranty against leaks caused by manufacturing defects. Meets the performance criteria of ASTM D412, ASTM D2196, ASTM D1475 and ASTM D1644.
 - 1. Basis of Design: GAF FlexSeal™ Roof Sealant or approved equal.
- J. One part butyl based high viscosity sealant suitable for sealing between flashing membrane and substrate surface behind exposed termination bars and for sealing between roofing membrane and drain flange.
 - 1. Basis of Design: GAF EverGuard® Water Block or approved equal.
- K. 100% solids epoxy based two-part sealant suitable for filling sealant pans at irregularly-shaped penetrations. Epoxy is part A. Polyamide is part B.
 - 1. Basis of Design: GAF EverGuard® 2-Part Pourable Sealant or approved equal.

2.05 ACCESSORIES

A. FLASHING ACCESSORIES

- 1. A smooth type, unreinforced thermoplastic polyolefin based membrane for use as an alternative flashing/reinforcing material for penetrations and corners. Required whenever preformed vent boots cannot be used, available in White, Tan, Gray, Regal Red, Regal Blue, and Hartford Green, 0.055 inches (55 mils) nominal thickness and sheet size: 24in x 50ft.
 - a) Basis of Design: GAF EverGuard® TPO Detailing Membrane, or approved equal.
- 2. An 8 inch wide smooth type, polyester scrim reinforced thermoplastic polyolefin membrane strip for use as a cover strip over coated metal and stripping-in coated metal flanges and general repairs: 0.045 inches (45 mils) nominal thickness with 100 foot length.
 - a) Basis of Design: GAF EverGuard® TPO Flashing Membrane or approved equal.
 - b) Color: To be selected from Manufacturer's full range.
- 3. Extruded aluminum termination bar with angled lip caulk receiver and lower leg bulb stiffener. Pre-punched slotted holes at 6" on center or 8" on center. ¾" x 10' with 0.090" cross section.

- a) Basis of Design: GAF EverGuard® Lip Termination Bar or approved equal.
- 4. A 6 inch wide, smooth type, heat-weldable polyester scrim reinforced thermoplastic polyolefin membrane strip. Designed for use as a cover strip over non-coated metal edges and flanges. Each full roll contains approximately 100 Lineal Ft. of material, 6" X 100'.
 - a) Basis of Design: GAF EverGuard® TPO Heat-Weld Cover Tape or approved equal.
- 5. .045" reinforced TPO membrane with pressure sensitive adhesive, to be installed on horizontal surfaces using plates and fasteners as a base attachment in fully adhered systems. Size 6" x 100'.
 - a) Basis of Design: GAF EverGuard® RTA (Roof Transition Anchor) Strip™ or approved equal.
- 6. 24 gauge steel with 0.025" thick TPO based film as required for fabrication into metal gravel stop and drip edge profiles, metal base and curb flashings, sealant pans, and scupper sleeves. Standard sheet size 4' x 10', sheet weight 47 lbs.
 - a) Basis of Design: GAF EverGuard® TPO Coated Metal or approved equal.

B. WALL & CURB ACCESSORIES

- 1. 55 mil TPO membrane and 24 gauge coated metal prefabricated into standard and custom size thru wall scuppers. Available in two sizes: 4" x 6" x 12" (l x w x d) with a 5.75" x 3.75" opening and 8" x 10" x 12" (l x w x d) with a 9.75" x 7.75" opening.
 - a) Basis of Design: GAF EverGuard® TPO Scupper or approved equal.
- 2. .045" thick reinforced TPO membrane fabricated corners. Available in four standard sizes to flash curbs that are 24", 36", 48", and 60" in size. Four corners are required to flash the curb.
 - a) Basis of Design: GAF EverGuard® Corner Curb Wraps or approved equal.
- 3. 0.045" thick molded TPO membrane outside corners of base and curb flashing. Hot-air welds directly to TPO membrane. Size 4" x 4" with 6" flange.
 - a) Basis of Design: GAF EverGuard® TPO Universal Corners or approved equal.
- 4. 0.055" molded TPO membrane inside corners of base and curb flashing. Hot-air welds directly to TPO membrane. Size 6" x 6" x 5.5" high.
 - a) Basis of Design: GAF EverGuard® TPO Preformed Corners or approved equal.
- 5. 8" diameter, nominal .050" vacuum formed unreinforced TPO membrane for use in flashing outside corners of base and curb flashings.
 - a) GAF EverGuard® TPO Fluted Corner or approved equal.

C. PENETRATION ACCESSORIES

- 1. 0.075" thick molded TPO membrane sized to accommodate most common pipe and conduits, (1" to 6" diameter pipes), including square tube. Hot-air welded directly to TPO membrane, supplied with stainless steel clamping rings.
 - a) Basis of Design: GAF EverGuard® TPO Preformed Vent Boots or approved equal..
- 2. 0.045" thick molded TPO membrane preformed boots are split to accommodate most common pipes and conduits and available in three standard sizes.
 - a) Basis of Design: GAF EverGuard® TPO Split Pipe Boots or approved equal.
- 3. 0.045" thick molded TPO membrane preformed square boots are split to accommodate most common square penetrations and conduits and available in three standard sizes.
 - a) Basis of Design: GAF EverGuard® TPO Square Tube Wraps or approved equal.
- 4. .070 thick molded penetration pocket to provide structure and foundation for the application of a pourable sealant for a variety of roof penetrations, weldable and 9" x 6" x 4" (l x w x h).
 - a) Basis of Design: GAF EverGuard® TPO Pourable Sealer Pocket or approved equal.

5. .055" thick smooth type, unreinforced thermoplastic polyolefin membrane designed for use as a conforming membrane seal over T-joints in 60 and 80 mil membrane applications.
 - a) Basis of Design: GAF EverGuard® TPO Drain or approved equal.
6. Aluminum drain unit coated with a weldable TPO compound. TPO membrane can be heat welded directly to the drain body, resulting in a strong, secure installation. Each drain is fitted with a BlueSeal® mechanical drain seal for a secure, tight seal into the building drain system. Available in two sizes (3" and 4"), and custom sizes are available.
 - a) Basis of Design: GAF Everguard® TPO Coated Metal Drain or approved equal.

D. FIELD OF ROOF ACCESSORIES

1. Pre-manufactured expansion joint covers used to bridge expansion joint openings in a roof structure. Fabricated to accommodate all roof to wall and roof to roof applications, made of .060" reinforced TPO membrane, available in 5 standard sizes for expansion joint openings up to 8" wide.
 - a) Basis of Design: GAF EverGuard® TPO Expansion Joint Covers or approved equal.
2. .055" thick smooth type, unreinforced thermoplastic polyolefin membrane designed for use as a conforming membrane seal over T-joints in 60 and 80 mil membrane applications.
 - a) Basis of Design: GAF EverGuard® T-Joint Patches or approved equal.
3. 1/8" thick extruded and embossed TPO roll 34" x 50', heat welds directly to roofing membrane. Unique herringbone traction surface.
 - a) Basis of Design: GAF EverGuard® TPO Walkway Rolls or approved equal.
 - b) Color: Gray

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that the surfaces and site conditions are ready to receive work.
- B. Verify that the deck is supported and secured.
- C. Verify that the deck is clean and smooth, free of depressions, waves, or projections, and properly sloped to drains, valleys, eaves, scuppers or gutters.
- D. Verify that the deck surfaces are dry and free of ice or snow.
- E. Verify that all roof openings or penetrations through the roof are solidly set, and that all flashings are tapered.

3.02 INSTALLATION - GENERAL

- A. Install TPO roofing system according to all current application requirements in addition to those listed in this section.
 1. Basis of Design System: GAF EverGuard® TPO Specification #: TFATI60EXFB
- B. Start the application of membrane plies at the low point of the roof or at the drains, so that the flow of water is over or parallel to, but never against the laps.

3.03 INSULATION - GENERAL

- A. Do not apply roof insulation or roofing until all other work trades have completed jobs that require them to traverse the deck on foot or with equipment. A vapor retarder coated lightly with asphalt may be applied to protect the inside of the structure prior to the insulation and final roofing installation. Before the application of the insulation, any damage or deterioration to the vapor retarder must be repaired.
- B. Do not install wet, damaged or warped insulation boards.
- C. Install insulation boards with staggered board joints in one direction (unless taping joint).
- D. Install insulation boards snug. Gaps between board joints must not exceed ¼". All gaps in excess of ¼" must be filled with like insulation material.
- E. Wood nailers must be 3-1/2" minimum width or 1" wider than metal flange. They shall be of equal thickness as the insulation, and be treated for rot resistance. All nailers must be securely fastened to the deck.
- F. Do not kick insulation boards into place.
- G. Miter and fill the edges of the insulation boards at ridges, valleys and other changes in plane to prevent open joints or irregular surfaces. Avoid breaking or crushing of the insulation at the corners.
- H. Insulation should not be installed over new lightweight insulating concrete.
- I. Roof tape, if required over insulation joints, must be laid evenly, smoothly and embedded in a uniform coating of hot steep asphalt with 4" end laps. Care must be taken to assure smooth application of tape, and full embedment of the tape in the asphalt.
- J. Do not install any more insulation than will be completely waterproofed each day.

3.04 INSULATION – BASE LAYER

- A. The substrate must be free of debris, dust, dirt, oil, grease, and standing water before applying the adhesive.
- B. Install insulation layers applied with rows of specified 2-Part Roofing Adhesive spaced 12" O.C. Insulation boards are to be placed immediately on the wet adhesive, but not walked into place or compressed into the adhesive until the adhesive has begun to thicken and started to develop its initial bond. After the adhesive has attained its initial bond strength the boards can be "walked-in" and will be compressed to the deck or substrate exhibiting minimal slippage or movement. The boards should be exposed to minimum traffic for at least 10-20 minutes after they have been "walked-in-place" to avoid breaking the freshly formed bond.
- C. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of 6" to eliminate continuous vertical gaps.

3.05 INSULATION – SUBSEQUENT LAYERS

- A. The substrate must be free of and debris, dust, dirt, oil, grease, and standing water before applying the adhesive.
- B. Install insulation layers applied with rows of specified 2-Part Roofing Adhesive spaced 12” O.C. Insulation boards are to be placed immediately on the wet adhesive, but not walked into place or compressed into the adhesive until the adhesive has begun to thicken and started to develop its initial bond. After the adhesive has attained its initial bond strength the boards can be “walked-in” and will be compressed to the deck or substrate exhibiting minimal slippage or movement. The boards should be exposed to minimum traffic for at least 10-20 minutes after they have been “walked-in-place” to avoid breaking the freshly formed bond.
- C. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of 6” to eliminate continuous vertical gaps.
- D. Do not install any more insulation than will be completely waterproofed each day.

1.02 MEMBRANE APPLICATION

- A. Fully Adhered:
 - 1. Place membrane so that wrinkles and buckles are not formed. Any wrinkles or buckles must be removed from the sheet prior to permanent attachment. Roof membrane shall be fully adhered immediately after it is rolled out, followed by welding to adjacent sheets.
 - 2. Overlap roof membrane a minimum of 3” for side laps and 3” for end laps.
 - 3. Install membrane so that the side laps run across the roof slope lapped towards drainage points.
 - 4. All exposed sheet corners shall be rounded a minimum of 1”.
 - 5. Use full width rolls in the field and perimeter region of roof.
 - 6. Use appropriate bonding adhesive for substrate surface, applied with a solvent-resistant roller, brush or squeegee.
 - 7. Apply bonding adhesive at 6 squares of finished, mated surface area per 5 gallons (Low VOC). A greater quantity of bonding adhesive may be required based upon the substrate surface condition.
 - 8. Prevent seam contamination by keeping the adhesive application a few inches back from the seam area.
 - 9. Adhere approximately one half of the membrane sheet at a time. One half of the sheet’s length shall be folded back in turn to allow for adhesive application. Lay membrane into adhesive once the bonding adhesive is tacky to the touch.
 - 10. Roll membrane with a weighted roller to ensure complete bonding between adhesive and membrane.
 - 11. Membrane laps shall be heat-welded together. All welds shall be continuous, without voids or partial welds. Welds shall be free of burns and scorch marks.
 - 12. Weld shall be a minimum of 1-1/2” in width for automatic machine welding and a minimum 2” in width for hand welding.
 - 13. All cut edges of reinforced membrane must be sealed with specified TPO Cut Edge Sealant.

14. Supplemental membrane attachment is required at the base of all walls and curbs, and where the angle of the substrate changes by more than five (5) degrees (1" in 12"). Roofing membrane shall be secured to the structural deck with appropriate Drill-Tec™ screws and plates spaced every 12" o.c. The screws and plates must be installed no less than ½" from the membrane edge. Alternatively, the roofing membrane may be turned up the vertical plane a minimum of 3" and secured with screws and termination bar. Fastener spacing is the same as is used for in-lap attachment. The termination bar must be installed within 1-1/2" to 2" of the plane of the roof membrane, with a minimum of 1" of membrane extending above the termination bar.
15. Supplemental membrane attachment to the structural deck is required at all penetrations unless the insulation substrate is fully adhered to the deck. Roofing membrane shall be secured to the deck with appropriate Drill-Tec™ screws and plates.
16. Fasteners must be installed to achieve the proper embedment depth. Install fasteners without lean or tilt.
17. Install fasteners so that the plate or termination bar is drawn down tightly to the membrane surface. Properly installed fasteners will not allow the plate or termination bar to move (underdriving), but will not cause wrinkling of the membrane (overdriving).

1.03 FLASHINGS

- A. All penetrations must be at least 24" from curbs, walls, and edges to provide adequate space for proper flashing.
- B. Flash all perimeter, curb, and penetration conditions with coated metal, membrane flashing, and flashing accessories as appropriate to the site condition.
- C. All coated metal and membrane flashing corners shall be reinforced with preformed corners or non-reinforced membrane.
- D. Hot-air weld all flashing membranes, accessories, and coated metal. A minimum 2" wide (hand welder) weld or minimum 1 - 1/2" automatic machine weld is required.
- E. Non-coated metal edge details must be installed in accordance with current Manufacturer's construction details and requirements.
- F. All twenty (25) year systems require the use of coated metal edges where applicable. Bonding adhesive and/or cover tape is not acceptable.
- G. All cut edges of reinforced membrane must be sealed with specified TPO Cut Edge Sealant.
- H. Consult the Manufacturer's *Application and Specifications Manual* or Contractor Services for more information on specific construction details.

1.04 ROOF PROTECTION

- A. Protect all partially and fully completed roofing work from other trades until completion.
- B. Whenever possible, stage materials in such a manner that foot traffic is minimized over completed roof areas.

- C. When it is not possible to stage materials away from locations where partial or complete installation has taken place, temporary walkways and platforms shall be installed in order to protect all completed roof areas from traffic and point loading during the application process.
- D. Temporary tie-ins shall be installed at the end of each workday and removed prior to commencement of work the following day.

1.05 CLEAN-UP

- A. All work areas are to be kept clean, clear and free of debris at all times.
- B. Do not allow trash, waste, or debris to collect on the roof. These items shall be removed from the roof on a daily basis.
- C. All tools and unused materials must be collected at the end of each workday and stored properly off of the finished roof surface and protected from exposure to the elements.
- D. Dispose of or recycle all trash and excess material in a manner conforming to current EPA regulations and local laws.
- E. Properly clean the finished roof surface after completion, and make sure the drains and gutters are not clogged.
- F. Clean and restore all damaged surfaces to their original condition.

END OF SECTION

SECTION 077100 - ROOF SPECIALTIES

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. Copings.
2. Roof-edge specialties.
3. Roof-edge drainage systems.
4. Reglets and counterflashings.

- B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 076200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
3. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

1.3 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Shop Drawings: For roof specialties.

1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
4. Detail termination points and assemblies, including fixed points.
5. Include details of special conditions.

- C. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For each type of roof specialty.
- C. Product Test Reports: For copings and roof-edge flashings, for tests performed by a qualified testing agency.
- D. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.
- B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.8 WARRANTY

- A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 075423 Thermoplastic Polyolefin (TPO) Roofing.
- B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. FM Approvals' Listing: Manufacture and install copings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COPINGS

- A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.
 - 1. Formed Aluminum Sheet Coping Caps: Aluminum sheet, 0.050 inch thick.
 - a. Surface: Smooth, flat finish.
 - b. Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.
 - 2. Corners: Factory mitered and soldered.
 - 3. Coping-Cap Attachment Method: face leg hooked to continuous cleat with back leg fastener exposed, fabricated from coping-cap material.
 - a. Face-Leg Cleats: Concealed, continuous galvanized-steel sheet.

2.3 ROOF-EDGE SPECIALTIES

- A. Canted Roof-Edge Fascia and Gravel Stop: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous formed galvanized-steel sheet cant, 0.028 inch thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.
 - 1. Formed Aluminum Sheet Fascia Covers: Aluminum sheet, 0.050 inch thick.
 - a. Surface: Smooth, flat finish.
 - b. Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.
 - 2. Corners: Factory mitered and soldered.
 - 3. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
 - 4. Fascia Accessories: Overflow scuppers.

- B. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous metal receiver with integral drip-edge cleat to engage fascia cover and secure single-ply roof membrane. Provide matching corner units.
 - 1. Formed Aluminum Sheet Fascia Covers: Aluminum sheet, 0.050 inch thick.
 - a. Surface: Smooth, flat finish.
 - b. Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.
 - 2. Corners: Factory mitered and soldered.
 - 3. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
 - 4. Receiver: Aluminum sheet, 0.050 inch thick.
 - 5. Fascia Accessories: Overflow scuppers.

- C. One-Piece Gravel Stops: Manufactured, one-piece, metal gravel stop in section lengths not exceeding 12 feet, with a horizontal flange and vertical leg, drain-through fascia terminating in a drip edge, and concealed splice plates of same material, finish, and shape as gravel stop. Provide matching corner units.
 - 1. Formed Aluminum Sheet Gravel Stops: Aluminum sheet, 0.050 inch thick.
 - a. Surface: Smooth, flat finish.
 - b. Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.
 - 2. Corners: Factory mitered and soldered.

2.4 ROOF-EDGE DRAINAGE SYSTEMS

- A. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
 - 1. Aluminum Sheet: 0.040 inch thick.
 - 2. Gutter Profile: Style A according to SMACNA's "Architectural Sheet Metal Manual."
 - 3. Gutter Supports: Gutter brackets with finish matching the gutters.

- B. Downspouts: Plain rectangular complete with smooth-curve elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Formed Aluminum: 0.040 inch thick.

- C. Aluminum Finish: Two-coat fluoropolymer.
 - 1. Color: As selected by Architect from manufacturer's full range.

2.5 REGLETS AND COUNTERFLASHINGS

- A. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
 - 1. Formed Aluminum: 0.050 inch thick.
 - 2. Corners: Factory mitered and soldered.

3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
- B. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal:
 1. Formed Aluminum: 0.032 inch thick.
 - C. Accessories:
 1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
 2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
 - D. Aluminum Finish: Two-coat fluoropolymer.
 1. Color: As selected by Architect from manufacturer's full range.

2.6 MATERIALS

- A. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
- B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and finish indicated.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

2.7 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 1. Thermal Stability: ASTM D 1970/D 1970M; stable after testing at 240 deg F.
 2. Low-Temperature Flexibility: ASTM D 1970/D 1970M; passes after testing at minus 20 deg F.

2.8 MISCELLANEOUS MATERIALS

- A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

4. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
- B. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- C. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- E. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.9 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Coil-Coated Aluminum Sheet Finishes:
 1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- E. Aluminum Extrusion Finishes:
 1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 2604. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
 - 1. Apply continuously under copings, roof-edge specialties, reglets and counterflashings.
 - 2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

3.3 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 - 3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 - 4. Torch cutting of roof specialties is not permitted.
 - 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum and stainless-steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 - 1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
 - 2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

- E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.4 COPING INSTALLATION

- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.
 1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at 30-inch centers.

3.5 ROOF-EDGE SPECIALITIES INSTALLATION

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.6 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

- A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
- B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
 1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion-joint caps.
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.
 1. Provide elbows at base of downspouts at grade to direct water away from building.
 2. Connect downspouts to underground drainage system indicated.

3.7 REGLET AND COUNTERFLASHING INSTALLATION

- A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.
- B. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.
- C. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.8 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 077200 - ROOF ACCESSORIES

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. Roof curbs.
 - 2. Equipment supports.
 - 3. Pipe portals.
 - 4. Preformed flashing sleeves.
- B. Related Sections:
 - 1. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
 - 2. Section 077100 "Roof Specialties" for manufactured fasciae, copings, gravel stops, gutters and downspouts, and counterflashing.

1.3 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of roof accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof accessories.
 - 1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.
- C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Size and location of roof accessories specified in this Section.
 - 2. Method of attaching roof accessories to roof or building structure.
 - 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
 - 4. Required clearances.
- B. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

2.2 ROOF CURBS

- A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, straight sides, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

- C. Material: Aluminum sheet, 0.125 inch thick.
 - 1. Finish: Two-coat fluoropolymer.
 - 2. Color: As selected by Architect from manufacturer's full range.

- D. Construction:
 - 1. Curb Profile: Manufacturer's standard compatible with roofing system.
 - 2. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
 - 3. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
 - 4. Top Surface: Level top of curb, with roof slope accommodated by sloping deck-mounting flange or by use of leveler frame.
 - 5. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.
 - 6. Insulation: Factory insulated with 1-1/2-inch thick glass-fiber board insulation.
 - 7. Liner: Same material as curb, of manufacturer's standard thickness and finish.
 - 8. Nailer: Factory-installed wood nailer under top flange on side of curb, continuous around curb perimeter.
 - 9. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4-inch thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
 - 10. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.

2.3 EQUIPMENT SUPPORTS

- A. Equipment Supports: Internally reinforced perimeter metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded corner joints, integral metal cant, and integrally formed structure-mounting flange at bottom.

- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

- C. Material: Aluminum sheet, 0.090 inch thick.
 - 1. Finish: Two-coat fluoropolymer.
 - 2. Color: As selected by Architect from manufacturer's full range.

- D. Construction:
 - 1. Curb Profile: Manufacturer's standard compatible with roofing system.
 - 2. Insulation: Factory insulated with 1-1/2-inch thick glass-fiber board insulation.
 - 3. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
 - 4. Nailer: Factory-installed continuous wood nailers 3-1/2 inches wide under top flange on side of curb, continuous around support perimeter.
 - 5. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb of size and spacing required to meet wind uplift requirements.

6. Platform Cap: Where portion of equipment support is not covered by equipment, provide weathertight platform cap formed from 3/4-inch thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
7. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
8. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
9. Fabricate equipment supports to minimum height of 12 inches above roofing surface unless otherwise indicated.

2.4 PIPE AND DUCT SUPPORTS

- A. Fixed-Height Cradle-Type Pipe Supports: Polycarbonate pipe stand accommodating up to 1-1/2-inch diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.

2.5 PIPE PORTALS

- A. Curb-Mounted Pipe Portal: Insulated roof-curb units with welded or mechanically fastened and sealed corner joints, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom; with weathertight curb cover with single or multiple collared openings and pressure-sealed conically shaped EPDM protective rubber caps sized for piping indicated, with stainless-steel snaplock swivel clamps.
- B. Flashing Pipe Portal: Formed aluminum membrane-mounting flashing flange and sleeve with collared opening and pressure-sealed conically shaped EPDM protective rubber cap sized for piping indicated, with stainless-steel snaplock swivel clamps.

2.6 PREFORMED FLASHING SLEEVES

- A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and slotted metal collar.
 1. Metal: Aluminum sheet, 0.063 inch thick.
 2. Diameter: As required. Refer to MEP drawing.
 3. Finish: Manufacturer's standard.
- B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.
 1. Metal: Aluminum sheet, 0.063 inch thick.
 2. Height: 13 inches.
 3. Diameter: As required. Refer to MEP drawings.
 4. Finish: Manufacturer's standard.

2.7 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation.
 - 1. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 - 2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.
- B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 coated.
 - 1. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 - 2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.
- C. Aluminum Sheet: ASTM B 209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
 - 1. Exposed Coil-Coated Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer Finish: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 - 2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

2.8 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, thickness as indicated.
- C. Polyisocyanurate Board Insulation: ASTM C 1289, thickness and thermal resistivity as indicated.
- D. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, and complying with AWPA C2; not less than 1-1/2 inches thick.

- E. Underlayment:
 1. Self-Adhering, High-Temperature Sheet: Minimum 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 2. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 3. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
 4. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 5. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- G. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

2.9 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
 1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.

2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Roof Curb Installation: Install each roof curb so top surface is level.
- D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.
- E. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.
1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
- F. Preformed Flashing-Sleeve and Flashing Pipe Portal Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.

3.3 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.
- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 079200 - JOINT SEALANTS

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. Silicone joint sealants.
 - 2. Acrylic joint sealants (at PVC trim only).

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
1. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 2. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with glazing and gasket materials.
 3. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 5. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
 6. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 2. Conduct field tests for each kind of sealant and joint substrate.
 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.7 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- A. Description: Single-component, nonsag, plus and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
- B. Basis of Design: Dow Corning 791 Silicone Weatherproofing Sealant or approved equal.
 - 1. Refer to Field and Installation Sealant Application Procedures for specific installation requirements including but not limited to cleaning and priming.

2.3 ACRYLIC JOINT SEALANTS (at PVC trim only)

- A. Description: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF

2.4 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

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 hollow-metal work.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
- C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.
 - 1. Physical Performance: Level B according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Polystyrene.
 - 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
 - 3. Exterior Frames:
 - a. Materials: Metallic-coated steel sheet, minimum 16 ga, with minimum A40 coating.
 - b. Construction: Full profile welded.
 - 4. Interior Frames:
 - a. Materials: Metallic-coated steel sheet, minimum 18 ga, with minimum A40 coating.
 - b. Construction: Full profile welded.
 - 5. Exposed Finish: Prime.

2.2 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.053 inch thick.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.053 inch, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.3 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Glazing: Comply with requirements in Section 088000 "Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
 2. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
 3. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
 4. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
 5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - b. Compression Type: Not less than two anchors in each frame.
 - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
 6. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
 7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

8. Terminated Stops: Terminate stops 6 inches above finish floor with a 90-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
 - E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
 - F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.
 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 4. Provide loose stops and moldings on inside of hollow-metal work.
 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.5 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
- B. Factory Finish: Clean, pretreat, and apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, complying with SDI A250.3.
 1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.6 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 4. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
 - c. At Bottom of Door: 3/4 inch plus or minus 1/32 inch.
 - d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

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. Solid-core doors with wood-veneer faces.
 - 2. Factory finishing flush wood doors.
- B. Related Requirements:
 - 1. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction and trim for openings.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
 - 1. Dimensions and locations of blocking.
 - 2. Dimensions and locations of mortises and holes for hardware.
 - 3. Dimensions and locations of cutouts.
 - 4. Undercuts.
 - 5. Requirements for veneer matching.
 - 6. Doors to be factory finished and finish requirements.
- C. Samples for Initial Selection: For factory-finished doors.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.7 WARRANTY

- A. A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
 - 1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
 - 2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
- B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors:
 - 1. Grade: Premium, with Grade A faces.
 - 2. Species: Cherry.
 - 3. Cut: Plain Sliced.
 - 4. Match between Veneer Leaves: Book match.
 - 5. Assembly of Veneer Leaves on Door Faces: Center-balance match.
 - 6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.

7. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
8. Exposed Vertical and Top Edges: Same species as faces - edge Type A.
9. Core: Structural Composite Lumber.
10. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.
11. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

2.4 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Factory cut and trim openings through doors.
 1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

2.5 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Opaque Finish:
 1. Grade: Custom.
 2. Finish: WDMA TR-8/AWS System 9, UV Cured Acrylated Polyurethane.
 3. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 - 1. Install fire-rated doors according to NFPA 80.
 - 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
 - a. Comply with NFPA 80 for fire-rated doors.
 - b. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
 - 2. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

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 access doors and frames for walls and ceilings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details material descriptions, dimensions of individual components and profiles, and finishes.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Concealed Flanges:
 - 1. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
 - 2. Locations: Wall and ceiling.
 - 3. Door Size: 12"x12".
 - 4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage factory primed.
 - 5. Frame Material: Same material and thickness as door.
 - 6. Latch and Lock: Cam latch, screwdriver operated.

2.2 MATERIALS

- A. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- B. Aluminum Extrusions: ASTM B 221, Alloy 6063.
- C. Frame Anchors: Same material as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.3 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.

2.4 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

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. Exterior and interior storefront framing.
 - 2. Exterior and interior manual-swing entrance doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 - 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
 - 1. Joinery, including concealed welds.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.

- E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- F. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Preconstruction Laboratory Mockup Testing Submittals:
 - 1. Testing Program: Developed specifically for Project.
 - 2. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.
 - 3. Record Drawings: As-built drawings of preconstruction laboratory mockups showing changes made during preconstruction laboratory mockup testing.
- B. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.
- C. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by a qualified testing agency.
- D. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.
- E. Source quality-control reports.
- F. Field quality-control reports.
- G. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.
- B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront to include in maintenance manuals. Include ASTM C 1401 recommendations for post-installation-phase quality-control program.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

- B. Laboratory Mockup Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- E. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of storefront systems.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members: At design wind pressure, as follows:
1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.
 3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
 - a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.
- E. Structural: Test according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.
 2. Entrance Doors:
 - a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
 - b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

- G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
- H. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq ft.
 2. Maximum Water Leakage: According to AAMA 501.1. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.
- I. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.
- J. Energy Performance: Certify and label energy performance according to NFRC as follows:
1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.35 as determined according to NFRC 200.
 3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 50 as determined according to NFRC 500.
- K. Noise Reduction: Test according to ASTM E 90, with ratings determined by ASTM E 1332, as follows.
1. Outdoor-Indoor Transmission Class: Minimum 34.
- L. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
 - b. Low Exterior Ambient-Air Temperature: 0 deg F.
 - c. Interior Ambient-Air Temperature: 75 deg F.
- M. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed storefront system without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.2 MANUFACTURERS

- A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.3 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction: Thermally broken and Nonthermal. Refer to Storefront Schedule for required locations.
 - 2. Glazing System: Retained with structural sealant.
 - 3. Finish: High-performance organic finish.
 - 4. Fabrication Method: Field-fabricated stick system.
- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Materials:
 - 1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209.
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.
 - 2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 INSULATED SPANDREL PANELS

- A. Insulated Spandrel Panels: Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.
 - 1. Overall Panel Thickness: 1 inch.
 - 2. Exterior Skin: Aluminum.
 - a. Thickness: Manufacturer's standard for finish and texture indicated.
 - b. Finish: Match framing system.
 - c. Texture: Smooth.
 - d. Backing Sheet: 1/8-inch thick, tempered hardboard.

3. Interior Skin: Aluminum.
 - a. Thickness: Manufacturer's standard for finish and texture indicated.
 - b. Finish: Matching storefront framing.
 - c. Texture: Smooth.
 - d. Backing Sheet: 1/8-inch thick, tempered hardboard.
 4. Thermal Insulation Core: Manufacturer's standard rigid, closed-cell, polyisocyanurate board.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
 2. Smoke-Developed Index: 50 or less.

2.5 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
1. Door Construction: 2- to 2-1/4-inch overall thickness, with minimum 0.125-inch thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
 2. Door Design: Wide stile; 5-inch nominal width.
 3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.

2.6 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."
- B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section.
1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA standard referenced.
 2. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.
 - b. Accessible Interior Doors: Not more than 5 lbf to fully open door.

- C. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
 - 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- D. Continuous-Gear Hinges: Manufacturer's standard with stainless-steel bearings between knuckles, fabricated to full height of door and frame.
- E. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.
- F. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- G. Cylinders: As specified in Section 087100 "Door Hardware."
 - 1. Keying: Master key system. Permanently inscribe each key with a visual key control number and include notation "DO NOT DUPLICATE".
- H. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- I. Operating Trim: BHMA A156.6.
- J. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.
- K. Surface-Mounted Holders: BHMA A156.16, Grade 1.
- L. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.
- M. Weather Stripping: Manufacturer's standard replaceable components.
 - 1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
- N. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- O. Silencers: BHMA A156.16, Grade 1.
- P. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

2.7 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."

- B. Glazing Sealants: Comply with Section 088000 "Glazing."
- C. Structural Glazing Sealants: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in storefront system indicated.
 - 1. Color: As selected by Architect from manufacturer's full range of colors.
- D. Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.
 - 1. Color: Match structural sealant.

2.8 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.9 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.

4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- E. Storefront Framing: Fabricate components for assembly using screw-spline system.
- F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
1. At exterior doors, provide compression weather stripping at fixed stops.
 2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 2. At exterior doors, provide weather sweeps applied to door bottoms.
- H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.11 SOURCE QUALITY CONTROL

- A. Structural Sealant: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - 6. Seal perimeter and other joints watertight unless otherwise indicated.
- B. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.
- D. Install components plumb and true in alignment with established lines and grades.
- E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- F. Install glazing as specified in Section 088000 "Glazing."
- G. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

- H. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 ERECTION TOLERANCES

- A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.
 - 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of two tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.
- C. Structural-Sealant Adhesion: Test structural sealant according to recommendations in ASTM C 1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
 - 1. Test a minimum of two areas on each building facade.
 - 2. Repair installation areas damaged by testing.
- D. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.6 MAINTENANCE SERVICE

A. Entrance Door Hardware:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION 084113

SECTION 085200 - WOOD WINDOWS

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 vinyl-clad wood windows.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for wood windows.
- B. Shop Drawings: For wood windows.
 - 1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Samples: For each exposed product and for each color specified, 2 by 4 inches in size.
- D. Product Schedule: For wood windows. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each type of wood window, for tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For manufacturer's warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An installer acceptable to wood window manufacturer for installation of units required for this Project.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection, water leakage, and air infiltration.
 - c. Faulty operation of movable sash and hardware.
 - d. Deterioration of materials and finishes beyond normal weathering.
 - e. Failure of insulating glass.
 - 2. Warranty Period:
 - a. Window: 10 years from date of Substantial Completion.
 - b. Glazing Units: 20 years from date of Substantial Completion.
 - c. Vinyl Cladding: Lifetime warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain wood windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Window Certification: WDMA certified with label attached to each window.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
 - 1. Minimum Performance Class: LC.
 - 2. Minimum Performance Grade: 70
- C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.30 Btu/sq. ft. x h x deg F.
- D. Sound Transmission Class (STC): Rated for not less than 30 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.
- E. Outside-Inside Transmission Class (OITC): Rated for not less than 22 OITC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.
- F. Windborne-Debris-Impact Resistance: Capable of resisting impact from windborne debris based on testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 and requirements of authorities having jurisdiction.

2.3 WOOD WINDOWS

- A. Vinyl-Clad Wood Windows:
 - 1. Refer to drawings for Basis of Design products.
- B. Operating Types: Provide the following operating types in locations indicated on Drawings:
 - 1. Fixed.
 - 2. Double hung.
- C. Frames and Sashes: Fine-grained wood lumber complying with AAMA/WDMA/CSA 101/I.S.2/A440; kiln dried to a moisture content of not more than 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide; water-repellent preservative treated.
 - 1. Exterior Finish: Vinyl-clad wood.
 - a. Color: As selected by Architect from manufacturer's full range.
 - 2. Interior Finish: Manufacturer's standard color-coated finish.
 - a. Color: As selected by Architect from manufacturer's full range.
- D. Insulating-Glass Units: ASTM E 2190.
 - 1. Glass: ASTM C 1036, Type 1, Class 1, q3.
 - a. Kind: Fully tempered safety glass.
 - 2. Lites: Two.
 - 3. Filling: Fill space between glass lites with argon gas blend.
 - 4. Low-E Coating: Magnetron sputtered on second surface.
 - 5. Protective removable polyolefin film applied to glass surfaces No. 1 and No 4.
- E. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
 - 1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.
- F. Projected Window Hardware:
 - 1. Gear-Type Rotary Operators: Complying with AAMA 901 when tested according to ASTM E 405, Method A. Provide operators that function without requiring the removal of interior screens or using screen wickets.
 - 2. Hinges: Stainless-steel hinges with stainless-steel-reinforced, sliding nylon shoes.
 - 3. Single-Handle Locking System: Operates positive-acting arms that pull sash into locked position. Provide one arm on sashes up to 29 inches tall and two arms on taller sashes.
 - 4. Operator Stud Cover: Matching operator handle finish. Provide in locations where operator handle is removed for controlled access.
- G. Hung Window Hardware:
 - 1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
 - 2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
 - 3. Tilt Hardware: Releasing tilt latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.

- H. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
- I. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
 - 1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 ACCESSORIES

- A. Dividers (between panes of glass): Provide divider grilles in designs indicated for each sash lite.
 - 1. Material: Manufacturer's standard.
 - 2. Pattern: As indicated on Drawings.
 - 3. Profile: As selected by Architect from manufacturer's full range.
 - 4. Color: As selected by Architect from manufacturer's full range.

2.5 INSECT SCREENS

- A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.
 - 1. Type and Location: Full, inside for project-out and Full, outside for double-hung sashes.
- B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
 - 1. Tubular Framing Sections and Cross Braces: 0.024" rolled aluminum with chromate conversion coating and polyester painted finish. Color to be selected from Manufacturer's full range.
- C. Wire Fabric: 25-by-25 micro fine stainless steel wire with a polyester non-reflective coating.

2.6 FABRICATION

- A. Fabricate wood windows in sizes indicated. Include a complete system for installing and anchoring windows.
- B. Glaze wood windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.
- E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.
- B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- B. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.
 - 1. Keep protective films and coverings in place until final cleaning.
- C. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.
- D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 085200

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
- C. Related Sections:
 - 1. Division 08 Section “Hollow Metal Doors and Frames”.
 - 2. Division 08 Section “Flush Wood Doors”.
 - 3. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series.
 - 2. UL10C – Positive Pressure Fire Tests of Door Assemblies.
 - 3. ANSI/UL 294 – Access Control System Units.
 - 4. UL 305 – Panic Hardware.
 - 5. ULC-S132, Emergency Exit and Emergency Fire Exit Hardware.
 - 6. ULC-S533 – Egress Door Securing and Releasing Devices.
 - 7. ANSI/UL 437- Key Locks.
 - 8. ULC-S328, - Burglary Resistant Key Locks.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 - 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- D. Informational Submittals:
 - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

- A. **Manufacturers Qualifications:** Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. **Certified Products:** Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. **Installer Qualifications:** A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. **Door Hardware Supplier Qualifications:** Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. **Source Limitations:** Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
- F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- G. **Keying Conference:** Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- H. **Pre-Submittal Conference:** Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.

2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 3. Review sequence of operation narratives for each unique access controlled opening.
 4. Review and finalize construction schedule and verify availability of materials.
 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 1. Structural failures including excessive deflection, cracking, or breakage.
 2. Faulty operation of the hardware.
 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 1. Seven years for heavy duty cylindrical (bored) locks and latches.
 2. Five years for exit hardware.
 3. Twenty five years for manual overhead door closer bodies.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Guidelines for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Adjust exact model numbers, quantities, accessories, etc. as required to produce the intent of the door function listed. Products are identified by using door hardware designations, as follows:
 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.

- d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 - 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 - 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 - 4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
 - 5. Manufacturers:
 - a. Bommer Industries (BO).
 - b. Hager Companies (HA).
 - c. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
- B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
- 1. Manufacturers:
 - a. Bommer Industries (BO).
 - b. Hager Companies (HA).
 - c. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.3 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
 - 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
 - 2. Furnish dust proof strikes for bottom bolts.
 - 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 - 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 - 5. Manufacturers:
 - a. Door Controls International (DC).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

- B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
 - 1. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 - 2. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 - 3. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 - 4. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

2.4 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinders: Original manufacturer cylinders complying with the following:
 - 1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
 - 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
 - 4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - 5. Keyway: Manufacturer's Standard.
- D. Removable Cores: Provide removable cores as specified, core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.
- E. Patented Cylinders: ANSI/BHMA A156.5, Grade 1, certified patented cylinders employing a utility patented and restricted keyway requiring the use of a patented key. Cylinders are to be protected from unauthorized manufacture and distribution by manufacturer's United States patents. Cylinders are to be factory keyed with owner having the ability for on-site original key cutting.
 - 1. Patented key systems shall not be established with products that have an expired patent. Expired systems shall only be specified and supplied to support existing systems.
 - 2. Manufacturers:
 - a. Corbin Russwin (RU) – Access 3 AP.
 - b. Sargent (SA) – Degree DG1.
 - c. Schlage (SC) – Everest 29 SL.
- F. Keying System: Each type of lock and cylinders to be factory keyed.
 - 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.

2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 3. New System: Key locks to a new key system as directed by the Owner.
- G. Key Quantity: Provide the following minimum number of keys:
1. Change Keys per Cylinder: Two (2)
 2. Master Keys (per Master Key Level/Group): Five (5).
 3. Construction Keys (where required): Ten (10).
- H. Construction Keying: Provide temporary keyed construction cores.
- I. Key Registration List (Bitting List):
1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 2. Provide transcript list in writing or electronic file as directed by the Owner.

2.5 KEY CONTROL

- A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
1. Manufacturers:
 - a. Lund Equipment (LU).
 - b. MMF Industries (MM).
 - c. Telkee (TK).

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed.
1. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.
 2. Locks are to be non-handed and fully field reversible.
 3. Manufacturers:
 - a. Corbin Russwin Hardware (RU) – CL3300 Series.
 - b. Sargent Manufacturing (SA) – 10 Line.
 - c. Schlage (SC) – ND Series.

2.7 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.

3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.8 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
9. Rail Sizing: Provide exit device rails factory sized for proper door width application.
10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:

- a. Sargent Manufacturing (SA) - 80 Series.
 - b. No Substitution.
- C. Conventional Push Rail Exit Devices, Aluminum Entrances: ANSI/BHMA A156.3, Grade 1 certified panic devices furnished in the functions specified in the Hardware Sets. Push bar to be made of extruded aluminum, maximum projection of 3", available in clad or anodized architectural finishes. Exit device design to fit narrow (minimum 2"), medium, or wide stile aluminum door applications.
- 1. Manufacturers:
 - a. Adams Rite Manufacturing (AD) – 8000 Series.

2.9 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
- 1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
 - 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 - 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
 - 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 - 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 - 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
- 1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) – DC6000 Series.
 - b. Norton Door Controls (NO) – 7500 Series.
 - c. Sargent Manufacturing (SA) – 351 Series.

2.10 ARCHITECTURAL TRIM

- A. Door Protective Trim
- 1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, 050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

2.11 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

2.12 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 1. National Guard Products (NG).
 2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
 3. Reese Enterprises, Inc. (RE).

2.13 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.14 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.5 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.6 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.7 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
 - 1. Quantities listed are for each pair of doors, or for each single door.
 - 2. The supplier is responsible for handing and sizing all products.
 - 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

Hardware Sets

Set: 1.0

Doors: 101A, 101B

2 Continuous Hinge	CFM_SLF-HD1		PE
2 Concealed Vert Rod Exit	Kawneer 1686 with exterior trim lever	US32D	
2 Surface Closer	351 CPS	EN	SA
2 Drop Plate	351D	EN	SA
1 Threshold	254x4AFG x LAR x 9.125 x MSES25		PE
2 Sweep	3452CNB x LAR		PE

Notes: Perimeter and meeting stile gasket by door / frame manufacturer.

Set: 2.0

Doors: 102B

1 Continuous Hinge	CFM_SLF-HD1		PE
1 Rim Exit Device	Kawneer 1786 with exterior trim lever	US32D	
1 Surface Closer	351 CPS	EN	SA
1 Drop Plate	351D	EN	SA
1 Threshold	254x4AFG x LAR x 9.125 x MSES25		PE
1 Sweep	3452CNB x LAR		PE

Notes: Perimeter gasket by frame manufacturer.

Set: 3.0

Doors: 112A, 115A, 126B

1 Continuous Hinge	CFM_HD1		PE
1 Mortise Exit Device, Exit Only	8310 EO	US32D	SA
1 Surface Closer	351 CPS	EN	SA
1 Kick Plate	K1050 10" high 4BE CSK	US32D	RO
1 Threshold	254x4AFG x LAR x 9.125 x MSES25		PE
1 Gasketing	303AS (Head & Jambs)		PE
1 Rain Guard	346C x Door Width + 4"		PE
1 Sweep	3452CNB x LAR		PE

Set: 4.0

Doors: 126A, 127A

3 Hinge, Full Mortise, Hvy Wt	T4A3786 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Mortise Exit Device, Classroom	DG160 8313 ETP	US32D	SA
1 Core	DG1 6300	US15	SA
1 Surface Closer	351 H	EN	SA
1 Kick Plate	K1050 10" high 4BE CSK	US32D	RO
1 Wall Stop	409	US32D	RO
3 Silencer	608		RO

Set: 5.0

Doors: 105A

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Entry/Office Lock	DG160 28 10G05 LP	US26D	SA
1 Core	DG1 6300	US15	SA
1 Surface Closer	351 H	EN	SA
1 Kick Plate	K1050 10" high 4BE CSK	US32D	RO
1 Wall Stop	409	US32D	RO
3 Silencer	608		RO
2 Coat Hook	RM801	US26D	RO

Set: 6.0

Doors: 125A

6 Hinge, Full Mortise	TA2714 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Dust Proof Strike	570	US26D	RO
2 Flush Bolt	555 / 557 (As Required)	US26D	RO
1 Classroom Lock	DG160 28 10G37 LP	US26D	SA
1 Core	DG1 6300	US15	SA
2 Wall Stop	409	US32D	RO
2 Silencer	608		RO

Set: 7.0

Doors: 103A, 106A, 107A, 110A, 111A, 120A, 124A

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	DG160 28 10G37 LP	US26D	SA
1 Core	DG1 6300	US15	SA
1 Wall Stop	409	US32D	RO
3 Silencer	608		RO
1 Surface Closer	351 H	EN	SA

Set: 8.0

Doors: 123A, 123B

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	DG160 28 10G37 LP	US26D	SA
1 Core	DG1 6300	US15	SA
2 Kick Plate	K1050 10" high 4BE CSK	US32D	RO
1 Wall Stop	409	US32D	RO
3 Silencer	608		RO

Set: 9.0

Doors: 121A, 122A

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	DG160 28 10G37 LP	US26D	SA
1 Core	DG1 6300	US15	SA
1 Surface Closer	351 O	EN	SA
2 Kick Plate	K1050 10" high 4BE CSK	US32D	RO
1 Wall Stop	409	US32D	RO
3 Silencer	608		RO

Set: 10.0

Doors: 108A

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Privacy Lock	28 10U65 LP	US26D	SA
2 Kick Plate	K1050 10" high 4BE CSK	US32D	RO
1 Wall Stop	409	US32D	RO
1 Gasketing	S88D (Head & Jambs)		PE
2 Coat Hook	RM801	US26D	RO

Set: 11.0

Doors: 113A, 114A

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	DG160 28 10G37 LP	US26D	SA
1 Core	DG1 6300	US15	SA
1 Wall Stop	409	US32D	RO
1 Gasketing	S88D (Head & Jambs)		PE
1 Door Bottom	4131CRL 36"		PE

END OF SECTION 087100

SECTION 088000 - GLAZING

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. Glass for windows, doors, storefront framing.
 - 2. Glazing sealants and accessories.

1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- C. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturers of insulating-glass units with sputter-coated, low-E coatings.
- B. Product Test Reports: For insulating glass and glazing sealants, for tests performed by a qualified testing agency.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.
- B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.10 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

- B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

- A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
 - 1. Design Wind Pressures: As indicated on Drawings.
 - 2. Design Snow Loads: As indicated on Drawings.
 - 3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 - 4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: 6 mm.

2.4 GLASS PRODUCTS

- A. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
 - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
 - 2. Spacer: Manufacturer's standard spacer material and construction.
 - 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.5 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

2.6 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.7 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- I. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- J. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

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. Non-load-bearing steel framing systems for interior partitions.
 - 2. Suspension systems for interior ceilings and soffits.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
- B. Studs and Tracks: ASTM C 645.
 - 1. Steel Studs and Tracks:
 - a. Minimum Base-Metal Thickness: 0.0329 inch.
 - b. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide[one of] the following:
 - 1. Double-Track System: ASTM C 645 top outer tracks, inside track with 2-inch deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
 - 2. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

- D. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Minimum Base-Metal Thickness: 0.0329 inch.
 - 2. Depth: 7/8 inch.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- C. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges.
 - 1. Depth: 2-1/2 inches.
- D. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
 - 2. Steel Studs and Tracks: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.0329 inch.
 - b. Depth: 3-5/8 inches.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.

3.3 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
 - 2. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 - 1. Slip-Type Head Joints: Install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs and attach to underside of overhead structure.
- E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.4 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Carrying Channels (Main Runners): 48 inches o.c.
 - 2. Furring Channels (Furring Members): 16 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 4. Do not attach hangers to steel roof deck.
 - 5. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

- E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

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. Interior gypsum board.
 - 2. Exterior gypsum board for ceilings and soffits.
 - 3. Tile backing panels.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
 - 2. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
 - 3. Section 093013 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch long length for each trim accessory indicated.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

- C. Do not install panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
- B. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
 - 1. Thickness: 1/2 inch.
 - 2. Long Edges: Tapered.

2.4 EXTERIOR GYPSUM BOARD FOR SOFFITS

- A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.
 - 1. Core: 5/8 inch, Type X.

2.5 TILE BACKING PANELS

- A. Mold Resistant Gypsum Board:
 - 1. Thickness: 5/8 inch.

2.6 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.

- B. Exterior Trim: ASTM C 1047.
 - 1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.7 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.

- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 - 3. Tile Backing Panels: As recommended by panel manufacturer.

- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints, rounded or beveled panel edges,] and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

- D. Joint Compound for Exterior Applications:
 - 1. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

- E. Joint Compound for Tile Backing Panels:
 - 1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- D. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Wallboard Type: Vertical surfaces unless otherwise indicated.
 - 2. Ceiling Type: Ceiling surfaces.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 APPLYING TILE BACKING PANELS

- A. Mold Resistant Gypsum Board: At locations indicated to receive tile.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints [at locations indicated on Drawings] [according to ASTM C 840 and in specific locations approved by Architect for visual effect].
- C. Interior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners.
 2. LC-Bead: Use at exposed panel edges.
 3. Curved-Edge Cornerbead: Use at curved openings.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 1. Level 2: Panels that are substrate for tile and concealed areas.
 2. Level 4: At panel surfaces that will be exposed to view.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

- F. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

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. Porcelain tile.
 - 2. Glazed wall tile.
 - 3. Stone thresholds.
 - 4. Metal edge strips.
- B. Related Requirements:
 - 1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - 2. Section 092900 "Gypsum Board" for cementitious backer units.

1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product.
- D. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer is a five-star member of the National Tile Contractors Association.
 - 2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store liquid materials in unopened containers and protected from freezing.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile from single source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
 - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
 - 1. Stone thresholds.
 - 2. Cementitious backer units.
 - 3. Metal edge strips.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

2.3 TILE PRODUCTS

- A. Refer to Finish Plan for product information.

2.4 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

- B. Marble Thresholds: ASTM C 503/C 503M, with a minimum abrasion resistance of 10 according to ASTM C 1353 or ASTM C 241/C 241M and with honed finish.
 - 1. Description: Uniform, fine- to medium-grained white stone with gray veining.

2.5 SETTING MATERIALS

- A. Standard Dry-Set Mortar (Thinset): ANSI A118.1.
 - 1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.

2.6 GROUT MATERIALS

- A. Standard Cement Grout: ANSI A118.6.

2.7 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.
- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.8 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 CERAMIC TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors consisting of tiles 8 by 8 inches or larger.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Glazed Wall Tile: 1/16 inch.
 - 2. Porcelain Tile: 1/4 inch.
- H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- I. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
- J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

3.4 TILE BACKING PANEL INSTALLATION

- A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.5 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.6 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
 1. Ceramic Tile Installation: TCNA F113; thinset mortar.
 - a. Thinset Mortar: Standard dry-set mortar.
 - b. Grout: Sand-portland cement grout.
- B. Interior Wall Installations, Metal Studs:
 1. Ceramic Tile Installation: TCNA W244C or TCNA W244F; thinset mortar on cementitious backer units.
 - a. Thinset Mortar: Standard dry-set mortar.
 - b. Grout: Standard unsanded cement grout.

END OF SECTION 093013

SECTION 095123 - ACOUSTICAL TILE CEILINGS

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. Acoustical tiles for interior ceilings.
 - 2. Fully concealed, direct-hung, suspension systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each acoustical tile ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Units: Full-size tiles equal to 2 percent of quantity installed.
 - 2. Suspension-System Components: Quantity of each concealed grid and exposed component equal to 2 percent of quantity installed.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical tiles, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations:
 - 1. Suspended Acoustical Tile Ceilings: Obtain each type of acoustical ceiling tile and its suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class A according to ASTM E 1264.
 - 2. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL TILES

- A. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

2.4 METAL SUSPENSION SYSTEM

- A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, fully concealed, metal suspension system and accessories of type, structural classification, and finish indicated that complies with applicable requirements in ASTM C 635/C 635M.

- B. Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation.

2.5 ACCESSORIES

- A. Wire Hangers, Braces, and Ties: Provide wires as follows:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch diameter wire.
- B. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- C. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch diameter bolts.
- E. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.
- G. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical tiles in-place during a seismic event.

2.6 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for of suspension-system runners.
 - 1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
 - 2. Finish: Painted in color as selected from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

- A. Install suspended acoustical tile ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical tiles.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges of tiles so tile-to-tile joints are interlocked.
1. Fit adjoining tiles to form flush, tight joints. Scribe and cut tiles for accurate fit at borders and around penetrations through ceiling.
 2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tiles and moldings, spaced 12 inches o.c.
 3. Protect lighting fixtures and air ducts according to requirements indicated for fire-resistance-rated assembly.

3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 ADJUSTING

- A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095123

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

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. Resilient base.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- C. Samples for Initial Selection: For each type of product indicated.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.

- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

- A. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 - 1. Style and Location:
 - a. Style A, Straight: Provide in areas with carpet.
 - b. Style B, Cove: Provide in areas with resilient flooring.
- B. Thickness: 0.125 inch.
- C. Height: As indicated on Drawings.
- D. Lengths: Coils in manufacturer's standard length.
- E. Outside Corners: Preformed.
- F. Inside Corners: Preformed.
- G. Colors: As selected by Architect from full range of colors.

2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
- C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.
- D. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096519 - RESILIENT TILE FLOORING

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. Solid vinyl floor tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: Full-size units of each color and pattern of floor tile required.
- C. Samples for Initial Selection: For each type of floor tile indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 VINYL COMPOSITION FLOOR TILE

- A. Tile Standard: ASTM F 1066, Class 1, solid-color tile.
- B. Wearing Surface: Smooth.
- C. Thickness: 0.125 inch.
- D. Size: 12 by 12 inches.
- E. Colors and Patterns: As selected by Architect from full range of colors.

2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of [3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles square with room axis.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
 - 1. Apply two coats.
- E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096813 - TILE CARPETING

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 modular carpet tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include manufacturer's written installation recommendations for each type of substrate.
- B. Samples for Initial Selection: For each type of carpet tile.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI's "CRI Carpet Installation Standard."

1.8 FIELD CONDITIONS

- A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.9 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, the following:
 - a. More than 10 percent edge raveling, snags, and runs.
 - b. Dimensional instability.
 - c. Excess static discharge.
 - d. Loss of tuft-bind strength.
 - e. Loss of face fiber.
 - f. Delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. Products: Refer to Drawings.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.
- C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
 - 1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 - c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI's "Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns indicated on Drawings.
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI's "Carpet Installation Standard," Section 20, "Protecting Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 099113 - EXTERIOR PAINTING

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 surface preparation and the application of paint systems on exterior substrates.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates.
 - 2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.

1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Label each Sample for location and application area.

- C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As selected by Architect from manufacturer's full range.
 - 1. Twenty percent of surface area will be painted with deep tones.

2.2 METAL

- A. Provide following Sherwin Williams system or approved equal:
 - 1. 1st coat: Pro-Cryl Universal Primer, B66 Series
 - 2. 2nd coat: Pro Industrial Zero VOC Acrylic, B66 Series
 - 3. 3rd coat: Pro Industrial Zero VOC Acrylic, B66 Series

2.3 WOOD

- A. Provide following Sherwin Williams system or approved equal:
 - 1. 1st coat: Exterior Wood Primer, B42 Series
 - 2. 2nd coat: Resilience Exterior Acrylic Coating, K-40 Series
 - 3. 3rd coat: Resilience Exterior Acrylic Coating, K-40 Series

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Fiber-Cement Board: 12 percent.
 - 3. Wood: 15 percent.
 - 4. Gypsum Board: 12 percent.

- C. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 2. Sand surfaces that will be exposed to view, and dust off.
 3. Prime edges, ends, faces, undersides, and backsides of wood.

4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- K. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 4. Paint entire exposed surface of window frames and sashes.
 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

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 surface preparation and the application of paint systems on interior substrates.

1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As selected by Architect from manufacturer's full range.
 - 1. Twenty percent of surface area will be painted with deep tones.

2.2 WOOD

- A. Provide following Sherwin Williams system or approved equal:
 - 1. 1st coat: Premium Wall and Wood Primer, B28W8111 Series
 - 2. 2nd coat: Pro-Mar 200 Zero VOC Semi-Gloss, B31-2600 Series
 - 3. 3rd coat: Pro-Mar 200 Zero VOC Semi-Gloss, B32-2600 Series

2.3 GYPSUM BOARD

- A. Provide following Sherwin Williams system or approved equal:
 - 1. 1st coat: Pro-Mar 200 Zero VOC primer, B28W2600 Series
 - 2. 2nd coat: Pro-Mar 200 Zero VOC Latex Eg-shel, B20-2600 Series
 - 3. 3rd coat: Pro-Mar 200 Zero VOC Latex Eg-shel, B20-2600 Series

2.4 HOLLOW METAL DOORS, FRAMES, AND MISCELLANEOUS METAL SURFACES

- A. Provide following Sherwin Williams system or approved equal:
 - 1. 1st coat: Pro-Cryl Universal primer, B66 Series
 - 2. 2nd coat: Pro Industrial Zero VOC Acrylic, B66 Series
 - 3. 3rd coat: Pro Industrial Zero VOC Acrylic B66 Series

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Fiber-Cement Board: 12 percent.
 - 3. Wood: 15 percent.
 - 4. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
 - 1. SSPC-SP 2.
 - 2. SSPC-SP 3.
 - 3. SSPC-SP 7/NACE No. 4.
 - 4. SSPC-SP 11.
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- H. Aluminum Substrates: Remove loose surface oxidation.
- I. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

- E. Painting Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work (not in equipment rooms):
 - 1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - 2. Paint the following work where exposed in occupied spaces:
 - a. Equipment.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
 - 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 099123

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

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. Cast dimensional characters.

1.3 DEFINITIONS

- A. Illuminated: Illuminated by lighting source integrally constructed as part of the sign unit.

1.4 COORDINATION

- A. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For dimensional letter signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.
 - 4. Show locations of electrical service connections.
 - 5. Include diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
 - 1. Include representative Samples of available typestyles and graphic symbols.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- 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.

2.2 DIMENSIONAL CHARACTERS

- A. Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
 - 1. Character Material: Cast aluminum.
 - 2. Character Height: As indicated.
 - 3. Thickness: As indicated.
 - 4. Finishes: As indicated
 - 5. Mounting: As indicated.

2.3 DIMENSIONAL CHARACTER MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 1. Use concealed fasteners and anchors unless indicated to be exposed.
 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
 3. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 - b. Fastener Heads: For nonstructural connections, use flathead screws and bolts with tamper-resistant Allen-head slots unless otherwise indicated.
 4. Sign Mounting Fasteners:
 - a. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
 - b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
 4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 5. Internally brace signs for stability and for securing fasteners.
 6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
 7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

- B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
 - 1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match sign-background color unless otherwise indicated.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Verify that electrical service is correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

- B. Mounting Methods:
 - 1. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.
 - 2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
 - 3. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.
 - 4. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

- B. Remove temporary protective coverings and strippable films as signs are installed.

- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101419

SECTION 102113 - PHENOLIC-CORE TOILET COMPARTMENTS

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. Phenolic-core toilet compartments configured as toilet enclosures and urinal screens.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.
- B. Shop Drawings: For toilet compartments.
 - 1. Include plans, elevations, sections, details, and attachment details.
 - 2. Show locations of cutouts for compartment-mounted toilet accessories.
 - 3. Show locations of centerlines of toilet fixtures.
 - 4. Show locations of floor drains.
 - 5. Show ceiling grid, ceiling-mounted items, and overhead support or bracing locations.
- C. Samples for Initial Selection: For each type of toilet compartment material indicated.
 - 1. Include Samples of hardware and accessories involving material and color selection.
- D. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of toilet compartment.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Door Hinges: Two hinges with associated fasteners.
 - 2. Latch and Keeper: One latch and keeper with associated fasteners.
 - 3. Door Bumper: One door bumper with associated fasteners.
 - 4. Door Pull: One door pull with associated fasteners.
 - 5. Fasteners: Ten fasteners of each size and type.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in ICC A117.1 for toilet compartments designated as accessible.

2.2 PHENOLIC-CORE TOILET COMPARTMENTS

- A. Toilet-Enclosure Style: Overhead braced.
- B. Urinal-Screen Style: Floor anchored.
- C. Door, Panel, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges. Provide minimum 3/4-inch thick doors and pilasters and minimum 1/2-inch thick panels.
- D. Pilaster Shoes and Sleeves (Caps): Formed from stainless-steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
- E. Urinal-Screen Post: Manufacturer's standard post design of monolithic phenolic urinal screen cutout at bottom to form a post; with shoe and sleeve (cap) matching that on the pilaster.
- F. Brackets (Fittings):
 - 1. Stirrup Type: Ear or U-brackets, stainless steel.
 - 2. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

- G. Phenolic-Panel Finish:
 - 1. Facing Sheet Finish: Two colors and patterns in each room.
 - 2. Color and Pattern: As selected by Architect from manufacturer's full range, with manufacturer's standard.
 - 3. Edge Color: Manufacturer's standard.

2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.
 - 1. Hinges: Manufacturer's minimum 0.062-inch thick stainless-steel paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door. Mount with through-bolts.
 - 2. Latch and Keeper: Manufacturer's heavy-duty surface-mounted cast-stainless-steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
 - 3. Coat Hook: Manufacturer's heavy-duty combination cast-stainless-steel hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories. Mount with through-bolts.
 - 4. Door Bumper: Manufacturer's heavy-duty rubber-tipped cast-stainless-steel bumper at out-swinging doors. Mount with through-bolts.
 - 5. Door Pull: Manufacturer's heavy-duty cast-stainless-steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M.
- B. Aluminum Extrusions: ASTM B 221.
- C. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- D. Stainless-Steel Castings: ASTM A 743/A 743M.

2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- D. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at bottoms of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.
- E. Door Size and Swings: Unless otherwise indicated, provide 24-inch wide in-swinging doors for standard toilet compartments and 36-inch wide out-swinging doors with a minimum 32-inch wide clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels: 1/2 inch.
 - b. Panels and Walls: 1 inch.
 - 2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.
 - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.

- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113

SECTION 102239 - FOLDING PANEL PARTITIONS

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. Manually operated, acoustical panel partitions.

1.3 DEFINITIONS

- A. NIC: Noise Isolation Class.
- B. NRC: Noise Reduction Coefficient.
- C. STC: Sound Transmission Class.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For operable panel partitions.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing.
 - 1. Include Samples of accessories involving color selection.
- D. Delegated-Design Submittal: For operable panel partitions.
 - 1. Include design calculations for seismic restraints.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Partition track, track supports and bracing, switches, turning space, and storage layout.
 - 2. Suspended ceiling components.
 - 3. Structural members to which suspension systems are attached.

4. Size and location of initial access modules for acoustical tile.
 5. Items penetrating finished ceiling, including the following:
 - a. Lighting fixtures.
 - b. HVAC ductwork, outlets, and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Smoke detectors.
 - f. Access panels.
- B. Setting Drawings: For embedded items and cutouts required in other work, including support-beam, mounting-hole template.
- C. Qualification Data: For qualified Installer.
- D. Seismic Qualification Certificates: For operable panel partitions, tracks, accessories, and components, from manufacturer. Include seismic capacity of partition assemblies to remain in vertical position during a seismic event and the following:
 1. Basis for Certification: Indicate whether certification is based on analysis, testing, or experience data, according to ASCE/SEI 7.
 2. Detailed description of partition anchorage devices on which the certification is based and their installation requirements.
- E. Product Certificates: For each type of operable panel partition.
 1. Include approval letter signed by manufacturer acknowledging Owner-furnished panel facing material complies with requirements.
- F. Product Test Reports: For each operable panel partition, for tests performed by a qualified testing agency.
- G. Field quality-control reports.
- H. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.
 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
 - b. Seals, hardware, track, track switches, carriers, and other operating components.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of operable panel partitions.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic bracing of tracks to structure above.
- B. Seismic Performance: Operable panel partitions shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the partition panels will remain in place without separation of any parts from the system when subjected to the seismic forces specified."
- C. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
 - 1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.
 - 2. Noise-Reduction Requirements: Operable panel partition assembly, identical to partition tested for STC, tested for sound-absorption performance according to ASTM C 423, and rated for not less than the NRC indicated.

3. Noise-Isolation Requirements: Installed operable panel partition assembly, identical to partition tested for STC, tested for NIC according to ASTM E 336, determined by ASTM E 413, and rated for 10 dB less than STC value indicated.
- D. Fire-Test-Response Characteristics: Provide panels with finishes complying with one of the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 2. Fire Growth Contribution: Complying with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol.

2.2 OPERABLE ACOUSTICAL PANELS

- A. Operable Acoustical Panels: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.
- B. Panel Operation: Manually operated, paired panels.
- C. Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.
- D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.
 1. Panel Width: Equal widths.
- E. STC: Not less than 54.
- F. Panel Weight: 10 lb/sq. ft. maximum.
- G. Panel Thickness: Not less than 3 inches.
- H. Panel Materials:
 1. Steel Frame: Steel sheet, manufacturer's standard nominal minimum thickness for uncoated steel.
 2. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard minimum nominal thickness for uncoated steel.
- I. Panel Closure: Manufacturer's standard unless otherwise indicated.
 1. Initial Closure: Flexible, resilient PVC, bulb-shaped acoustical seal.
 2. Final Closure: Constant-force, lever-operated mechanical closure expanding from panel edge to create a constant-pressure acoustical seal.

- J. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.
 - 1. Hinges: Manufacturer's standard.

2.3 SEALS

- A. General: Provide seals that produce operable panel partitions complying with performance requirements and the following:
 - 1. Manufacturer's standard seals unless otherwise indicated.
 - 2. Seals made from materials and in profiles that minimize sound leakage.
 - 3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.
- B. Vertical Seals: Deep-nesting, interlocking steel astragals mounted on each edge of panel, with continuous PVC acoustical seal.
- C. Horizontal Top Seals: Continuous-contact, extruded-PVC seal exerting uniform constant pressure on track.
- D. Horizontal Bottom Seals: Manufacturer's standard continuous-contact seal exerting uniform constant pressure on floor.

2.4 PANEL FINISH FACINGS

- A. General: Provide finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.
 - 1. Apply one-piece, seamless facings free of air bubbles, wrinkles, blisters, and other defects, with edges tightly butted, and with no gaps or overlaps. Horizontal seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.
- B. Fabric Wall Covering: 100 percent polyester, from same dye lot, treated to resist stains.
 - 1. Color/Pattern: As selected by Architect from manufacturer's full range.
- C. Cap-Trimmed Edges: Protective perimeter-edge trim with tight hairline joints concealing edges of panel and finish facing, finished as follows:
 - 1. Steel, Painted: Finished with manufacturer's color as selected by Architect from manufacturer's full range.
- D. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

2.5 SUSPENSION SYSTEMS

- A. Tracks: Steel or aluminum mounted directly to overhead structural support, designed for operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.
 - 1. Panel Guide: Aluminum guide on both sides of the track to facilitate straightening of the panels; finished with factory-applied, decorative, protective finish.
 - 2. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.
- B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.
- C. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.
- D. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with ASTM E 557 except as otherwise required by operable panel partition manufacturer's written installation instructions.
- B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.
- C. Install panels from marked packages in numbered sequence indicated on Shop Drawings.
- D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.
- E. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

- F. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids. Adjust partitions for alignment and full closure of vertical joints and full closure along top and bottom seals.

3.3 ADJUSTING

- A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust pass doors to operate smoothly and easily, without binding or warping.
- C. Verify that safety devices are properly functioning.

3.4 MAINTENANCE SERVICE

- A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by manufacturer's authorized service representative. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operable-partition operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION 102239

SECTION 102800 - TOILET ACCESSORIES

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. Public-use washroom accessories.
 - 2. Private-use bathroom accessories.
 - 3. Underlavatory guards.
 - 4. Custodial accessories.

1.3 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Include electrical characteristics.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify accessories using designations indicated.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 TOILET ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. Products:
 - 1. Refer to drawings for Basis of Design.

2.3 UNDERLAVATORY GUARDS

- A. Underlavatory Guard:
 - 1. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
 - 2. Material and Finish: Antimicrobial, molded plastic, white.

2.4 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.5 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

SECTION 15400 - PLUMBING

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections apply to work specified in this Section; consult them in detail for applicable instructions.
- B. Manufacturers referenced in the technical specifications are for the purpose of establishing a standard of quality. Alternate manufacturers providing the same quality equipment will be given consideration by the Engineer and Architect if they are notified in writing in accordance with the Related Documents and Section 1.04 of these specifications.

1.2 DESCRIPTION

- A. **WORK INCLUDED:** Provide all labor, materials, equipment, plant, tools, and management services for proper and complete execution of all Plumbing work. Without restricting the generality of the foregoing, the following items of work are included:
 - 1. Complete gas piping from meters including all hangers, valves and seismic supports as required by N.J. seismic code. Provide final connection of gas piping to all equipment. Coordinate with local utility company requirements.
 - 2. Provide all domestic water distribution piping from site domestic water service 5'-0" outside of building, including all required pressure reducing valves, in accordance with water company requirements, escutcheons, final connections to fixtures.
 - 3. Complete drain, waste and vent systems to site sanitary 5'-0" outside the building, including cutting of concrete floor, trenching, all excavation, bedding, backfilling and compacting to excavating specifications, filling and patching, escutcheons, connections, cleanouts. Provide all connections to sanitary in accordance with NJUCC and National Standard Plumbing Code.
 - 4. Complete storm drainage system including roof drains, all storm drainage piping to site storm pipe 5'-0" outside building or as shown on the plans.
 - 5. Purchase, installation and connection/piping of the Plumbing Fixtures as specified on the drawings with fittings, stops and traps, in the locations and quantities shown on the Drawings.
 - 5. Perform all cutting & patching, and fire caulking/sealing for plumbing installation.
 - 6. Plumbing Contractor shall be responsible for coordination of all work with all other trades to avoid conflicts.
 - 7. Temporary water service as required to perform the Work.
 - 8. Sleeves for pipes passing through walls and partitions.
 - 9. Perform cleaning and protection of your work.
 - 10. Access doors where required in walls and ceilings for installation by appropriate surface Contractor.
 - 11. Control wiring, as required, for all equipment, per applicable codes.
 - 12. Seismic provisions, as required by code, for ALL plumbing systems and components.
 - 13. Backflow prevention (anti-siphon) for water systems, as required by code.
 - 14. Removal of all debris and rubbish related to this work.
 - 15. Lead free painting of exterior gas piping per Architect's direction.

- B. WORK EXCLUDED and included in other Sections:
 - 1. All power wiring to motors and starters, under "Electrical".
 - 2. HVAC work, under "HVAC".

1.3 CODES AND QUALITY ASSURANCE

- A. The Contractor is responsible for performing all work in a neat, workmanlike manner. All operating procedures shall be strictly adhered to. Each Bidder shall visit the site and become informed as to the conditions of the premises and the extent and character of the work required. No consideration will be granted for any alleged misunderstanding of the Work to be done.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- C. All Plumbing work, equipment and apparatus shall conform to the most recent requirements of the following:

NJUCC - New Jersey Uniform Construction Code
ADA - Americans with Disabilities Act
2018 International Mechanical Code
2018 International Building Code
Local Codes and Utility Requirements
ASHRAE Standard 90.1 2016 Energy Standard
NFPA - National Fire Protection Association
NSPC - National Standard Plumbing Code
ASTM - American Society for Testing and Materials
NEC - National Electrical Code of the NFPA 2014
ASME - American Society of Mechanical Engineers
National Board of Fire Underwriters
National Fuel Gas Code
UL - Underwriters' Labs.
Requirements of the Owner's Insurance Underwriter

Without additional cost to the Owner, provide such other labor and materials as are required to complete the Work of this Section in accordance with the regulations of the current editions of these codes, and the requirements of governmental agencies having jurisdiction, regardless of whether such materials and labor are called for elsewhere in these Specifications. These rules, regulations and codes shall govern as a minimum standard. In the event of conflict with the Contract Drawings or Specifications requiring workmanship or material of a higher quality than required by the above-mentioned rules, regulations, codes and authorities, the most stringent of these documents shall govern.

- D. During this work, the Contractor shall be responsible for maintaining safety among persons in his employ in accordance with the standards set by the OCCUPATIONAL SAFETY AND HEALTH ACT of 1970. The Engineer and Architect shall be held harmless for any accident, injury, or any other incident resulting from non-compliance with these or any other standards.
- E. Engineering Drawings are schematic with regard to exact locations and dimensions. Review all Drawings provided, including; Architectural and Structural Drawings, reflected ceiling plans, Plumbing, HVAC, and Electrical Drawings, to confirm all requirements and identify all

constraints. The Contractor shall coordinate his work with that of all other trades to avoid conflicts. It is the Contractor's responsibility to confirm that all equipment will fit. Any discrepancies or inconsistencies are to be reported immediately to the Architect and Engineer for clarification. Refer to the actual dimensions on the Architectural Drawings and successive related shop drawings.

- F. Examination of the site shall be made by the Contractor, who shall compare it with the Drawings and Specifications and who shall satisfy himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made for any extra expense incurred due to failure or neglect to make such examination.
- G. During the execution of work under this Contract the Contractor shall be responsible for protecting any equipment or structures in the work and adjacent areas.
- H. Secure and pay for required authorizations from governmental agencies having jurisdiction.
- I. All Work shall be guaranteed to be free from leaks or defects. Any defective materials or workmanship as well as damage to the work of all trades resulting from the same shall be replaced or repaired as directed for the duration of stipulated guarantee periods.
- J. COORDINATION: Each Contractor shall be responsible for coordinating their work with that of all other trades. No installation shall take place without approval of onsite entity (General Contractor, Construction Manager, etc.) responsible for coordination. Any work installed without approval and which interferes with the work of other trades that have been approved shall be removed and replaced at the Contractor's expense.
- K. EXPOSED PIPING, DUCTWORK AND CONDUIT: There shall be no exposed piping, ductwork or conduit of any sort; plumbing, HVAC or electrical, whether implied by the MEP drawings or not, unless expressly approved by the Architect.

1.4 SUBMITTALS

- A. Comply with pertinent provisions of all the General Conditions.
- B. Product data: In accordance with procedures outlined in the General Conditions, submit:
 - 1. Materials list of items proposed to be provided under this Section, with sources of supply and manufacture;
 - 2. Manufacturers' specifications, catalog cuts and other data needed to prove compliance with the specified requirements. Include shop standards for equipment, piping, cuts of hangers, clips, supports, attachments, anchors, etc., labeled as to the respective conditions or locations to which they apply.
 - 3. Product substitutions are to be requested in writing, and only in conformance with General Conditions procedures. At the time of submission of cuts for review for all substitutions, clearly indicate Specification Section, provide complete information on the original product and the proposed product for review, and all deviations.
 - a. Any substitutions requested by a contractor are to include all costs for related changes by other contractors. It is the responsibility of the contractor requesting the change to coordinate with any other trade impacted by the substitution.
- C. Samples:
 - 1. Provide Samples of items scheduled to be exposed in the final structure.

2. When specifically so requested by the Contractor and permitted by the Engineer, authorized samples will be returned to the Contractor for installation in the Work.

D. Shop Drawings:

1. Before fabrication or purchase of any work, major equipment or controls, prepare and submit for review, shop drawings of major equipment and scale layout and design of the complete domestic water, sanitary, and storm systems in accordance with General Conditions and Related Documents. Include all access provisions, etc. Coordinate all of the above with all other trades.
2. Prepare and submit Shop Drawings, showing at a scale not smaller than $\frac{1}{4}'' = 1'-0''$ all details of items to be shop fabricated under this Section. Maximum sheet size 30" x 42".
3. Clearly identify by circle and by note "DEVIATION" and by note "INTERFERENCE", in large bold lettering, and deviations from Drawings and Specifications and any potential or unresolved interference condition and assume full responsibility for failure to do so.
4. Submittal shall confirm fabrication and installation is in accordance with recommendations and applicable standards.
5. For mandatory coordination of all work, including that which penetrates structural members, consult all applicable General Conditions.

E. Installation Requirements: Furnish and erect all equipment, piping, hangers, vents, and all accessories specified, indicated on the drawings or required to assure proper operation of all systems installed under this Section and of all connected equipment furnished under other Sections of these Specifications but requiring services furnished under this Section.

F. Manuals: Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the Engineer four copies of an operation and maintenance manual compiled in accordance with the provisions of the General Conditions, and these Specifications. Include in each manual:

1. Copy of the authorized Record Documents of this portion of the Work.
2. Copies of all warranties and guarantees.

G. As-built Drawings (maintain in accordance with requirements of the General Conditions): Concurrent with the progress of the Work, the Contractor shall maintain a set of as-built record prints noting in red all changes in the Work. Upon completion of the Work this marked up set of prints is to be turned over to the Owner for his records.

H. All required permits, fees and inspections shall be arranged and paid for by the Contractor. The Contractor shall present to the Owner, properly signed, all required certificates of final inspection and authorization before the Work will be accepted as complete.

1.5 PRODUCT HANDLING

A. General Protection: Do not allow equipment, insulation material, piping or associated items to become wet, soiled or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

- A. Provide plumbing fixtures as shown on the Drawings with all hangers, supports and stops as required by code for a complete installation.
- B. Provide fixtures per schedule on drawings complying with latest edition of NSPC.
- C. The lavatory controls shall comply with Barrier Free requirements and shall comply with NSPC.

2.2 MATERIALS

- A. All materials entering into this work shall be new and shall be of the best of their respective kinds and shall be installed in a neat and workmanlike manner. The Contractor shall be entirely responsible for all apparatus, equipment, and appurtenances furnished by him or his Sub-Contractors in connection with this work and special care shall be taken to protect all parts thereof in such manner as may be necessary or as directed. This protection shall include covers, crating, sheds, or other means to prevent dirt, plaster, grit or other foreign substances from entering piping, fixtures or equipment. Special care shall be taken to keep all open ends of pipes, etc. closed while in storage or during installation. He shall be responsible for and shall make good any damages without additional cost.
- B. SOIL, VENT AND WASTE PIPING
 - 1. CAST IRON:
 - a. Above ground: All sanitary piping shall be cast iron “no-hub” pipe (Cast Iron Soil Pipe Standard 301), with neoprene gasket, stainless steel band, and clamp (Cast Iron Soil Pipe Institute Standard 301).
 - b. Below ground: all sanitary piping shall be PVC pipe and fittings, DWV (ASTM D2665).
- C. COPPER HOT AND COLD WATER DOMESTIC SERVICE PIPING:
 - 1. Provide type L complying with ASTM-B-88.
 - 2. Fittings shall be 150 psi rated cast brass soldered type.
 - 3. Soldered joints shall be made with a LEAD FREE SOLDER.
 - 4. All under-slab copper piping shall be soft, type K with NO JOINTS.
- D. BLACK STEEL PIPING
 - 1. Provide black steel, schedule 40, minimum 150 PSI, screwed malleable iron fittings, ASTM-A-120.
 - 2. Provide seismic restraints for all piping hangers longer than 12”.
 - 3. Provide Miro Plastic Pillow Block supports with straps for all piping on roof.
 - 4. All exterior black steel piping shall be painted with rust resistant paint.
- E. GAS PIPING
 - 1. Provide black steel, schedule 40, minimum 150 PSI, screwed malleable iron fittings, ASTM-A-120.
 - 2. Provide seismic restraints for all piping hangers longer than 12”.
 - 3. Provide Miro Plastic Pillow Block saddle type plastic supports with straps for all gas piping on roof and where required, manufactured by Industrial Combustion Associates, or authorized equal.
 - 4. Provide double-walled, sealed and vented gas piping wherever it is routed under the slab. Construction must meet National Fuel Gas Code, American Gas Association, OSHA, UL and all other local and applicable codes.
 - 5. Paint all exterior gas piping color as directed by Architect.
 - 6. Underground gas service piping shall schedule 80 seamless steel pipe with steel

welded fittings. Piping and fittings shall be mill-wrapped and asphaltum coated and shall comply with gas companies standards.

F. DIELECTRIC PIPE FITTINGS

1. Provide at all connections between dissimilar metals (e.g. steel, copper, iron, etc.), nylon insulator, Buna-N gasket, maximum temperature 210° F, 250 psig pressure rating, conforming to ANSI B16.39, B2.1 and B1.201 and Federal Specification WWU-531E and WWU-516B.

2.3 VALVE AND PIPING IDENTIFICATION

- A. Identify piping with pipe identification labels.
- B. Valves shall be designated by distinguishing numbers and/or letters on required chart(s) and/or diagram(s).

2.4 VALVES Provide UL Approved:

- A. GATE VALVES: Provide solid wedge disc, rising stem, 200# WOG; non-rising stem valves may be used only where there is insufficient clearance.
 1. 3" and smaller, rising stem: Provide Crane #428, bronze, screwed.
 2. 3" and smaller, non-rising stem: Provide Crane #438, bronze, screwed.
 3. 4" and larger: Provide Crane #465-1/2, IBBM, flanged, non-rising stem.
- B. BALL VALVES: Provide glass filled TFE seats suitable for 200° F water:
 1. 2" and smaller: Provide Nibco, bronze, screwed.
 2. 2-1/2" and larger: Provide Nibco, iron body, flanged, 200# WOG.
- C. BUTTERFLY VALVES: Provide in water lines, gear or lever operated, quarter turn flangeless type butterfly valves of the wafer stud, lug or alternate bolt wafer type, cast iron body per ATSM A126, aluminum bronze disc per ASTM B148 C95400, type 416 stainless steel stem ASTM A582 type 416 and TFE bushings. These valves shall be rated 150 psi, bi-directional differential pressure, with a 150 psi dead end service rating. The cast iron body shall have extended neck for 2" insulation. No exposed fasteners in the waterway to pin the disc to the stem will be acceptable. Liner shall be elastomer, reinforced with a phenolic backing ring and able to be field replaceable. Positive stem retention required. All gear operators are mounted directly to the valve, totally exposed, life-time lubricated and gasketed, weatherproof, high strength body, iron segment gears and high strength worm gears. Handwheel operators to be standard. NIBCO, APCO or Owner authorized equivalent.
- D. CHECK VALVES:
 1. 3" and smaller: Provide Crane #37, bronze, screwed, Y-pattern, 200# WOG, swing check type.
 2. 4" and larger: provide Crane #373, IBBM, flanged, 200# WOG.
- E. GAS COCKS: Gas cocks DeZurick No. 425 with RS-49 plug seal, screwed.
- F. STRAINERS: Provide Y-pattern, 200# WOG, 20 mesh monel screen:
 1. 3" and smaller: Provide Crane #988-1/2, screwed.
 2. 4" and larger: Provide Crane #989-1/2, flanged.

G. PRESSURE REGULATORS

1. Provide Mueller H-9000, or Wilkins series 500, all bronze.
2. Install with brass strainer upstream of regulator.

H. PARTITION STOP VALVES: Provide Chicago Faucet #1771, loose key type.

I. BALANCING COCKS: Provide DeZurick #400.

J. CLEANOUTS: Provide cleanouts on all soil, waste and roof drain lines, at ends of all lines, at all changes in direction exceeding 45 degrees, where leaving the building, and not over 50 ft. apart at all horizontal or vertical runs.

1. Floors:
 - a. Provide Smith #4023 or Josam #8330 with round nickel-bronze top in finished room floors.
 - b. Provide Smith #4223 or Josam #8090-CAL with round cast iron top in unfinished room floors.
 - c. Provide "flush-with-floor" type cleanouts, with adjustable watertight covers and integral anchoring flange with clamping collar where waterproofing membrane is used.
2. Finished walls:
 - a. Provide Smith #4532 or Josam #8790-4 with round chrome plated or stainless steel access plate and screw.
3. Provide cleanout plugs of extra heavy bronze.

K. VENT LINES: Where small vent lines pass through roof structures, provide pipe increasers as required by local code.

2.5 PIPE HANGERS

A. WATER, GAS AND PLASTIC PIPING

1. Provide VMC (Vibration Mountings & Controls Inc.) Series SH spring flex hangers with appropriate split ring or trapeze type connectors.
2. Provide seismic restraints for all piping hangers longer than 12". All seismic restraints shall be in accordance with BOCA.

B. Where hangers are of the specific length requiring seismic support of pipes, provide VMC series RSH-30A hangers with pipe sleeves and 45 degree seismic restraint cables.

C. Paint hangers per instruction of the Architect.

2.6 INSULATION

A. Insulate all hot and cold water piping above ground and ceilings with 1½" Owens-Corning Fiberglas "25asj/ssl" insulation for pipes up to 1 1/2" and 2" thick fiberglass insulation for pipes 2" and up. Provide with a factory applied vapor barrier unless noted otherwise. Provide plastic covers for all elbows, T's and other joints and changes in direction. Insulation shall have outer PVC jacket and label and arrow.

B. Under sinks, insulate all exposed hot water and cold water piping and valves, and drain piping with "Handi Lav-Guard" insulation kits made by Truebro Inc., PO Box 429, Ellington, CT, 06029. (860) 875-2868, or authorized equal.

- C. Insulate all interior storm piping with 1” fiberglass.

2.7 SLEEVES

- A. Where pipes pass through concrete, masonry, or stud walls, provide "Sperzel" rustproof "Crete-Sleeve" of the size required.

2.8 ACCESS DOORS

- A. Access panels of the types shown on the drawings, in ceramic tile, gypsum wallboard, or other finished surface, required for access to valves, etc. on plumbing lines, will be furnished by this Contractor and installed by the Contractor for the applicable surface.
- B. It shall be the Plumbing Contractor's responsibility to take a count of all such panels required, transmit this information to the respective Contractor and see that they are installed where required, so that no plumbing equipment is left in an inaccessible location.

2.9 WATER HAMMER ARRESTORS

- A. Provide water hammer arrestors on hot and cold water lines, Smith Hydrotrol 5000 series.
 - 1. Install in upright position at all quick closing valves, solenoids, isolated plumbing fixtures, and supply headers at plumbing fixture groups.
 - 2. Locate and size in accordance with Plumbing and Drainage Institute Standard WH-201.
 - 3. Install water hammer arrestors behind access panels.

2.10 GAS EQUIPMENT VENTING

- A. Provide stack with draft hoods (as required), to connect gas-fired equipment to vertical vent line through roof. Vent shall be galvanized sheet metal construction in accordance with National Fuel Gas Code, NFPA Standard 54, ANSI 2223.1 and the BOCA Mechanical Code.
- B. Provide double wall type B gas vent. Gas vent shall be aluminum inner wall and galvanized steel outer wall. Provide galvanized steel flashing and waterproofing at top and around gas vent. Chimney and cap shall be built to conform to UL-103. Provide appropriate supports for vent and stack cap. Breidert or authorized equal.

2.11 OTHER MATERIALS

- A. Provide all other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the authorization of the Engineer.

PART 3 - EXECUTION

3.1 TEMPORARY WATER

- A. Provide temporary water service as required to perform the Work, and for all trades.

3.2 EXISTING CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.3 PLUMBING SYSTEM PREPARATION AND LAYOUT

- A. Refer to Architectural Drawings for exact locations and dimensions.
- B. Layout the plumbing system in careful coordination with the Drawings, determining proper elevations for all components of the system and using only the minimum number of bends to produce a satisfactorily functioning system.
- C. Coordination:
 - 1. Coordinate as necessary with other Sections to assure proper and adequate provision in the work of those Sections for interface with the work of this Section. Coordinate the installation of items with the schedule for work of other trades to prevent unnecessary delays in the total work.
 - 2. Where devices and equipment are not specifically located on the Drawings, locate as determined in the field by the Architect. Where plumbing fixtures and equipment are installed without such specific direction, relocate as directed by the Architect and at no additional cost to the Owner.
 - 3. Verify all measurements at the Site. No extra compensation will be allowed because of differences between work shown on the Drawings and actual measurements at the site of construction.
 - 4. Where items are shown in conflict with locations of structural members and mechanical or other equipment, provide required supports to clear the encroachment.
 - 5. Coordinate equipment locations and sizes with trades responsible for constructing the walls, floors and ceilings in which they are to be mounted.
- D. Data indicated on the Drawings and in these Specifications are intended to convey the Engineer's intentions only, as such their accuracy is not warranted. The exact locations, distances, levels, and other conditions will be governed by actual construction and the Drawings and Specifications should be used only for guidance in such regard.

3.4 INSTALLATION OF PIPING AND EQUIPMENT

- A. GENERAL:
 - 1. Thoroughly clean items before installation. Cap pipe openings to exclude dirt until fixtures are installed and final connections have been made.
 - 2. Cut pipe accurately, and work into place without springing or forcing, properly clearing windows, doors, and other openings. Excessive cutting or other weakening of the building will not be permitted.
 - 3. Show no tool marks or threads on exposed plated, polished, or enameled connections from fixtures. Tape all finished surfaces to prevent damage during construction.
 - 4. Make changes in directions with fittings; make changes in main sizes with eccentric reducing fittings. Unless otherwise noted, install water supply and return piping with straight side of eccentric fittings at top of the pipe.
 - 5. All drainage piping shall be run as straight as possible. Run horizontal sanitary and storm drainage piping at a uniform grade of 1/8" per ft. unless otherwise noted. Make change in direction of drainage piping by appropriate use of 45° wyes, long turn tee wyes, long sweep quarter, sixth, eighth, or sixteenth bends except where space conditions require, short turn sanitary tees may be used on vertical lines only.

6. Provide sufficient swing joints, ball joints, expansion loops, and devices necessary for a flexible piping system.
7. Support piping independently at pumps, coils, tanks, and similar locations, so that weight of pipe will not be supported by the equipment.
8. Securely bolt all equipment, isolators, hangers, and similar items in place.
9. Support each item independently from other pipes. Do not use wire for hanging or strapping pipes.
10. Provide complete dielectric insulating couplings between ferrous and non-ferrous metals.
11. Provide union and shut off valves suitably located to facilitate maintenance and removal of equipment and apparatus.
12. All water piping shall be concentrated and run as direct as possible but parallel to construction and ABOVE CEILING in all finished rooms. Water supply lines to wall hung fixtures, or to fixtures set near or against the wall shall be stubbed through the wall and not up through the floor.
13. Water supply pipes throughout the building shall be located within the building in such a manner as to provide thorough protection from freezing.
14. All water piping shall be run level and generally free of traps and unnecessary bends arranged to conform to the building requirements and to suit the necessities of clearances for other mechanical and electrical work.
15. All piping shall have reducing or increasing fittings where any change in the pipe sizes occur. No bushings of any nature will be allowed.
16. No valve stems shall be installed below the centerline of the piping it serves.
17. Run vent piping with elbows at changes of direction or grade to drain out condensation.
18. Cleanouts shall be provided where required by code. Cleanouts shall be installed at all changes in direction, at the base of all leaders and where shown on the Drawings.
19. Underground cleanouts shall be extended to the finished floor with long radius fittings.

B. CHASES, SLOTS, AND OPENINGS

1. Chases, slots and openings in floor, walls, or partitions will be built in by each Contractor in his respective material as shown on the drawings and as directed as the work progresses. This Contractor shall familiarize himself with the size of chases, slots, and openings to be provided by other Contractors, to receive his work and shall see that they are properly located and of proper size. This Contractor shall provide all chase access doors for installation by Drywall or Masonry Contractor. If these chases have to be cut after walls are built he shall provide same as required. This Contractor shall install his work sufficiently in advance of the building construction to permit his work to be built into walls, floors, and partitions to eliminate unnecessary cutting of construction work.
2. He shall not cut any chases or any structural members without first securing the approval of the Architect and Engineer.

C. PLUMBING FIXTURE INSTALLATION:

1. Set fixtures level and in proper alignment with respect to walls and floors, and with fixtures spaced equally or as indicated.
2. Provide supplies in proper alignment with fixtures and with each other.
3. Provide flush valves in alignment with the fixture, without vertical or horizontal offsets.
4. Grout wall and floor mounted fixtures watertight where the fixtures are in contact with walls and floors.
5. Caulk deck-mounted trim at the time of assembly. Caulk self-rimming sinks.

- D. CONTROL WIRING: Furnish all necessary control wiring to provide complete functioning equipment and systems, as required by, and to the standards of, all applicable codes and requirements.
- E. BRANCH VALVING:
1. Install shutoff valves at every bathroom, classroom, mechanical equipment room, and any other room or area with one or more plumbing or water consuming fixtures to facilitate the immobilization of all fixtures for maintenance without the immobilization of any other room or area's fixtures or equipment.
 2. Shut off valves shall be installed on both cold water and hot water piping branches as described above, whether shown on the drawings or not.
- F. EXCAVATION AND BACKFILLING: This Contractor shall do all excavating and backfilling necessary for installation of his work and in accordance with the Contract Documents and all applicable codes and standards.
- G. EQUIPMENT ACCESS: Install piping, equipment, and accessories to permit access for maintenance. Relocate items as necessary to provide such access, and without additional cost to the Owner.
- H. For electrically operated equipment, verify the electrical characteristics actually available for the work of this Section, and provide equipment meeting those characteristics.

3.5 PIPE JOINTS

A. COPPER TUBING

1. Cut square, remove burrs, and clean inside of female fitting to a bright finish.
 - a. Apply solder flux with brush to tubing.
 - b. Remove internal parts of solder-end valves prior to soldering.
2. Provide dielectric unions at points of connection of copper tubing to ferrous piping and equipment.
3. For joining copper tubing, use:
 - a. Water piping 3" and smaller: 95-5 solder.
 - b. Water piping larger than 3": Sil-fos" brazing.
4. Use only LEAD-FREE SOLDER.

B. SCREWED PIPING

1. Deburr cuts.
 - a. Do not ream exceeding internal diameter of the pipe.
 - b. Thread to requirements of ANSI B2.1.
2. Use teflon tape on male thread prior to joining other services.

C. SOLVENT CEMENTED JOINTS

1. Deburr Cuts and apply solvent with brush to tubing. Cement coating is to be complete and uniform on both fittings.
2. Provide screwed connections at points of connection of PVC tubing to ferrous tubing.

D. LEAKY JOINTS

1. Remake with new material.
2. Remove leaking section and/or fitting as directed.
3. Do not use thread cement or sealant to tighten joints.

3.6 PIPE SUPPORTS

- A. Support suspended piping with clevis or trapeze hangers and rods.
- B. Space hangers and support for horizontal steel pipes according to the following schedule:

Pipe size:	Maximum spacing on centers:
¾" and smaller:	10'-0"
1" and greater:	12'-0"
- C. Space hangers and supports for horizontal copper tubing according to the following schedule:

Tube size:	Maximum spacing on centers:
1 ¼" and smaller:	6'-0"
1 ½" and over:	10'-0"
- D. Cast Iron Soil Pipe: at 5 foot intervals and behind every hub.
- E. Space hangers and supports for horizontal PVC pipe four feet maximum for all sizes.
- F. Support vertical piping with riser clamps secured to the piping and resting on the building structure.
- G. Provide insulation continuous through hangers and rollers. Protect insulation by galvanized steel shields.
- H. Arrange pipe supports to prevent excessive deflection, and to avoid excessive bending stress.
- I. It is the option of the Contractor to fasten piping directly to walls above ceilings, support from walls above ceilings or support it from building structures above ceilings.
- J. MATERIALS: All hangers and supports shall be as manufactured by VMC, Inc.

3.7 SLEEVES AND OPENINGS

- A. Provide sleeves for each pipe passing through walls, partitions, floors and ceilings.
 1. For uninsulated pipe, provide sleeves two pipe sizes larger than the pipe passing through, or provide a minimum of 1/2" clearance between inside and outside of the pipe.
 2. For insulated pipe, provide sleeves of adequate size to accommodate the full thickness of pipe covering, with clearance for packing and caulking.
- B. Caulk the space between sleeve and pipe or pipe covering, using a non-combustible, permanently plastic, waterproof, non-staining compound which leaves a smooth finished appearance, or pack with noncombustible cotton, rope, or fiberglass to within 1/2" of both wall faces.
- C. FINISH AND ESCUTCHEONS
 1. Smooth up rough edges around sleeves with plaster or spackling compound.

2. Provide 1" wide chrome or nickel plated escutcheons on all pipes exposed to view where passing through walls, floors, partitions, ceilings, and similar locations.
 - a. Size the escutcheons to fit pipe and a covering.
 - b. Hold escutcheons in place with set screws.
- D. INTUMESCENT FIRE BARRIER PLASTIC PIPE CAULKING: Provide where plastic pipe penetrates a rated wall, intumescent-type sealant complying with UL Fire Resistance Directory and ULC Volume 3 Fire Resistance Ratings, UL classified for use with PVC, CPVC, CCPVC, ABS, CCABS, PVDF, PP, PB and FRPP, HILTI FS-ONE or authorized equal.

3.8 CLEANOUTS

- A. Secure the Architect's approval of locations for cleanouts in finished areas prior to installation.
- B. Cleanout sizes shall conform to NSPC.
- C. Make cleanouts accessible. After pressure tests are made and authorized, thoroughly graphite the cleanout threads.
- D. Provide cleanouts every 50' on 5" pipe and under, and every 100' on 6" pipe and larger.

3.9 VALVES

- A. Provide valves in water and gas systems. Locate and arrange so as to give complete regulation of apparatus, equipment, and fixtures.
- B. Provide valves in at least the following locations:
 1. In branches and/or headers of water piping servicing a group of fixtures.
 2. On both sides of all apparatus and equipment.
 3. For shutoff of risers and branch mains.
 4. For flushing and sterilizing the system.
 5. Where shown on the Drawings.
 6. At all low points of each water system.
 7. At all 90 degree "Tee" branches or connections.
- C. Locate valves for easy accessibility and maintenance.
- D. Identify all valves with brass, die stamped identification tags.

3.10 BACKFLOW PREVENTION

- A. General: Provide backflow preventers for domestic water system as required by the water company, Watts Type 909 double backflow preventers or equal.
- B. Protect plumbing fixtures, faucets with hose connections, and other equipment having plumbing connections, against possible back-siphonage.
- C. Arrange for testing of backflow devices as required by the governmental agencies having jurisdiction.

3.11 DISINFECTION AND STERILIZATION OF POTABLE WATER SYSTEM

- A. New or repaired potable water systems shall be disinfected prior to use whenever required by the Administrative Authority. The method shall be as follows:
 - 1. The pipe system shall be flushed with potable water until no dirty water appears at the points of outlet.
 - 2. The system or part thereof shall be filled with a water-chlorine solution containing at least 50 parts per million chlorine and the system or part thereof shall be valved off and allowed to stand for 24 hours, or the system or part thereof shall be filled with a water-chlorine solution containing at least 200 parts per million of chlorine and allowed to stand for 3 hours.
 - 3. Following the allowed standing time, the system shall be flushed with potable water until no chlorine remains in the water coming from the system.
 - 4. The procedure shall be repeated if it is shown by a bacteriological examination made by the Administrative Authority that contamination still persists in the system.

3.12 TESTING, ADJUSTING AND BALANCING

- A. Advise Architect in writing when systems and equipment are ready for testing, adjusting and balancing for Architect to schedule required inspection to verify that systems are in proper condition and to schedule testing and balancing work.
- B. Provide personnel and equipment, and arrange for and pay the costs of, all required tests and inspections required by authorized representatives of the manufacturers of the equipment and governmental agencies having jurisdiction.
- C. Immediately prior to beginning of testing and balancing, provide the following:
 - 1. Adjust all balancing cocks, valves and dampers open.
 - 2. Fill, vent and clean all water systems.
 - 3. Place all equipment in operating condition.
 - 4. Clean all strainers.
- D. Where tests show materials or workmanship deficient, replace or repair as necessary, and repeat the tests until the specified standards are achieved at no extra cost to Owner.
- E. TESTING OF GAS PIPING: Test piping according to the requirements of all applicable codes, standards and utility companies.
- F. TESTING OF SANITARY AND STORM DRAINAGE SYSTEM
 - 1. Upon completion of all rough plumbing, wastes and vents, this Contractor shall test same to roof. The entire new drainage system must be tested by the Plumbing Contractor who shall close the end of the house drain, all vertical lines and branches, to fixtures to points above the finished floors and beyond the finished face of the walls and partitions. If the drain or any part of the system is to be tested separately, there must be a head of water at least 10 feet above all parts of the work so tested, held for a minimum of one (1) hour, and special provision must be made for all parts including all joints and connections in at least one test.
- G. TESTING OF WATER PIPING
 - 1. All water piping shall be thoroughly flushed to remove all foreign material after the roughing-in is completed. After the fixtures have been connected, the supply line shall be flushed again.
 - 2. Piping shall be tested per NSPC.

3. Relief and regulating valves shall be set and checked to see that they operate properly. Relief valves shall be tested to determine that they open at the proper pressure and temperature.
4. Water heaters shall be tested and checked to determine that they operate in compliance with the specifications. All controls shall be properly adjusted.

H. GENERAL REQUIREMENTS FOR TESTING

1. Should a leak occur during any test, the system shall be drained, the leaking fitting removed, the pipe thoroughly cleaned, and new fittings installed according to these specifications. Reheating leaking fittings in the line will not be permitted.
2. All defects disclosed as the result of tests shall be remedied and defective work or material shall be replaced and tests repeated.
3. All tests shall be performed as required and until satisfactory results are achieved, and no pipe shall be concealed until authorized by the Architect.
4. Expense involved in making a separate test or tests shall be paid for by the PC when it is required to separately test any of the plumbing system so as to advance the progress of the construction work. Any test made will not be construed as an acceptance of any material so tested or will it affect the guarantee of the work. All leaks which appear because of these tests shall be repaired by the Plumbing Contractor.
5. All testing shall be completed before insulation is applied, and underground piping shall be tested before any backfilling.

3.13 CLEANING

- A. Clean work furnished and installed as part of the Plumbing Work, including but not limited to equipment, control panels and devices.
- B. Construction Facilities and Temporary Controls for cleaning during construction.
 1. Remove debris, leftover piping, tubing, metal, insulation, cartons, papers, etc., resulting from Plumbing Work.
 2. Remove all rust, dirt, etc., from Plumbing Work to be painted and maintain in condition ready for painting.

3.14 DEMONSTRATION

- A. Prior to Final Completion, thoroughly demonstrate and instruct Owner's designated representatives in care and operation of all plumbing systems and equipment provided in Plumbing Work Prime Contract. Provide necessary skilled labor to operate all systems for not less than 5 days and provide required instruction.
 1. In addition to Prime Contractor's instruction, arrange for technically qualified factory representatives to train Owner's representative in care, maintenance, and operation of following manufacturer's equipment and systems.
 - a. Temperature controls.
 - b. Boilers and burners
 2. Coordinate and schedule time and place of all training through Architect at Owner's convenience.
 3. Submit letters verifying satisfactory completion of all instruction including date of instruction, names of persons in attendance and countersigned by authorized representative of Owner.

4. Until final acceptance, Prime Contractor retains full responsibility for systems, even though operated by Owner's personnel during instruction, unless otherwise agreed in writing.
5. During instruction, provide list, sealed in clear plastic, outlining operating, maintenance, and starting precautions and procedures to be followed by Owner for operating systems and equipment.

3.15 PROTECTION

A. Maintenance of Systems During Temporary Use

1. Lubricate bearings in Plumbing Work systems during temporary use.
2. Maintain limit controls, overload devices, and safety controls in operating condition during use

3.16 GUARANTEE

- #### A. Guarantee all Plumbing work for a period of one year after date of completion as measured from date of acceptance by the Owner. Promptly repair and make good any damage to his or the work of other Contractors or Subcontractors during that period that may be caused by defective materials or workmanship. Correct any defects in materials and workmanship without further expense to the Owner. Deliver said written guarantee at time of Owner's acceptance.

3.17 DEBRIS REMOVAL

- #### A. Routinely remove, in an orderly and efficient manner, (and cart away and dispose of, by legal means, off the site and premises), all debris related to work of this Section; worksite and staging areas shall be kept clear of all debris on a daily basis.

END OF SECTION - 15400

SECTION 15600 - HVAC

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections apply to work specified in this Section; consult them in detail for applicable instructions.
- B. Manufacturers referenced in the technical specifications are for the purpose of establishing a standard of quality. Alternate manufacturers providing the same quality equipment will be given consideration by the Engineer and Architect if they are notified in writing.

1.2 DESCRIPTION

- A. **WORK INCLUDED:** Provide all labor, materials, equipment, plant, tools, and management services for proper and complete execution of all HVAC work. Without restricting the generality of the foregoing, the following items of work are included:
 - 1. Provide new, complete HVAC systems, including eight (8) single zone constant volume split system gas fired HVAC units, one (1) precision split cooling system and one (1) single phase VRV heat pump system, including gas furnaces, filters, controls, transformers, wiring, volume dampers, and all necessary accessories to complete the system.
 - 2. Furnish and install all refrigerant and condensate piping, combustion intake and exhaust piping, drain pans, accessories, traps and insulation.
 - 3. Provide air distribution systems including diffusers, ductwork, dampers, turning vanes, collars, registers and grilles, and acoustical lining.
 - 4. Provide insulation of all interior supply and outside air ductwork and refrigerant piping.
 - 5. Provide exhaust fans, gravity vents and electric heaters.
 - 6. Provide high efficiency motors for all HVAC equipment with high-energy efficiency. Provide soft start drives or VFD's for all motors 5 hp and up. Furnish and mount starters, controllers, motorized zone dampers, transformers and provide all of the power wiring for all of the transformers and zone dampers as well as all of the control wiring for all of the transformers and zone dampers.
 - 7. Provide fire dampers in all 1 HR/2HR rated walls and ceilings, where required by code whether or not shown on the drawings.
 - 8. Provide complete electronic Automatic Temperature Control Systems including all control wiring and power wiring for control panels.
 - 9. Install duct smoke detectors, furnished by Electrical Section, in return ductwork. (Coordinate with Electrical Section). Duct detector must report back to main panel. Provide access panels to service
 - 10. Coordinate all ductwork with Plumbing Contractor to assure that DUCTWORK IS INSTALLED FIRST with Plumbing work to follow.
 - 11. Provide supports, hangers, pass through and watertight sleeves, counter-flashing and similar related work.
 - 12. Determine locations of systems and components in the field.
 - 13. Perform all cutting and patching, including fire caulking and sealing for the HVAC installation. Provide intumescent firestop sealant at all floor and fire wall penetrations.
 - 14. Provide for the testing, adjusting and balancing of all HVAC systems, by an independent, licensed, test and balance company.

15. Provide written operating and maintenance instructions for all HVAC aspects.
16. Furnish access doors where required in partitions, masonry walls, and in ceilings, affording access to dampers and other controls.
17. Secure and pay for all required authorizations and permits.
18. Coordinate with work of all other trades.
19. Removal of all debris related to this work.
20. Standards herein apply to similar work performed under other Sections.
21. Seismic provisions, as required by code, for ALL HVAC systems and components.
22. Provide control wiring for HVAC equipment.

1.3 CODES AND QUALITY ASSURANCE

- A. The Contractor is responsible for performing all work in a neat, workmanlike manner. All operating procedures shall be strictly adhered to. Each Bidder shall visit the site and become informed as to the conditions of the premises and the extent and character of the work required. No consideration will be granted for any alleged misunderstanding of the Work to be done.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- C. All HVAC work, equipment and apparatus shall conform to the most recent requirements of the following:

NJUCC - New Jersey Uniform Construction Code
 2018 International Building Code
 2018 International Mechanical Code
 ASHRAE Standard 90.1 2016 Energy Standard
 ADA - Americans with Disabilities Act
 Local Codes and Utility Requirements
 NFPA - National Fire Protection Association
 NSPC - National Standard Plumbing Code
 AMCA - Air Movement and Control Association, Inc.
 SMACNA - Sheet Metal and Air Conditioning Contractors National Association, Inc.
 ASHRAE - American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.
 ASTM - American Society for Testing and Materials
 NEC - National Electrical Code of the NFPA 2014
 ASME - American Society of Mechanical Engineers
 National Fuel Gas Code
 ADC - Air Diffusion Council
 AABC - Associated Air Balance Council
 ARI - Air Conditioning and Refrigeration Institute
 National Board of Fire Underwriters
 UL - Underwriters' Labs.
 Requirements of the Owner's Insurance Underwriter

Without additional cost to the Owner, provide such other labor and materials as are required to complete the Work of this Section in accordance with the regulations of the current editions of these codes, and the requirements of governmental agencies having jurisdiction, regardless of whether such materials and labor are called for elsewhere in these Specifications. These rules, regulations

and codes shall govern as a minimum standard. In the event of conflict with the Contract Drawings or Specifications requiring workmanship or material of a higher quality than required by the above-mentioned rules, regulations, codes and authorities, the most stringent of these documents shall govern.

- D. During this work, the Contractor shall be responsible for maintaining safety among persons in his employ in accordance with the standards set by the OCCUPATIONAL SAFETY AND HEALTH ACT of 1970. The Engineer and Architect shall be held harmless for any accident, injury, or any other incident resulting from non-compliance with these or any other standards.
- E. Drawings are schematic with regard to exact locations and dimensions. Review all Drawings provided, including; Architectural and Structural Drawings, reflected ceiling plans, Plumbing, HVAC, and Electrical Drawings, to confirm all requirements and identify all constraints. The Contractor shall coordinate his work with that of all other trades to avoid conflicts. It is the Contractor's responsibility to confirm that all equipment will fit. Any discrepancies or inconsistencies are to be reported immediately to the Architect and Engineer for clarification. Refer to the actual dimensions on the Architectural Drawings and successive related shop drawings. Exact locations of diffusers, registers, thermostats shall be directed by Architect.
- F. Examination of the site shall be made by the Contractor, who shall compare it with the Drawings and Specifications and who shall satisfy himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made for any extra expense incurred due to failure or neglect to make such examination.
- G. During the execution of work under this Contract the Contractor shall be responsible for protecting any equipment or structures in the work and adjacent areas.
- H. Secure and pay for required authorizations from governmental agencies having jurisdiction.
- I. All Work shall be guaranteed to be free from leaks or defects. Any defective materials or workmanship as well as damage to the work of all trades resulting from the same shall be replaced or repaired as directed for the duration of stipulated guarantee periods.
- J. COORDINATION: Each Contractor shall be responsible for coordinating their work with that of all other trades. No installation shall take place without approval of onsite entity (General Contractor, Construction Manager, etc.) responsible for coordination. Any work installed without approval and which interferes with the work of other trades that have been approved shall be removed and replaced at the Contractor's expense.
- K. EXPOSED PIPING, DUCTWORK AND CONDUIT: There shall be no exposed piping, ductwork or conduit of any sort in areas with hung ceilings, whether implied by the MEP drawings or not, unless expressly approved by the Architect.

1.4 SUBMITTALS

- A. Comply with pertinent provisions of the General Conditions.
- B. Product data: In accordance with procedures outlined in the General Conditions, submit:

1. Materials list of items proposed to be provided under this Section, with sources of supply and manufacture;
2. Manufacturers' specifications, catalog cuts and other data needed to prove compliance with the specified requirements. Include shop standards for ductwork fabrication, cuts of duct hangers, clips, supports, attachments, anchors, etc., labeled as to the respective conditions or locations to which they apply.
3. Product substitutions are to be requested in writing, and only in conformance with General Conditions procedures. At the time of submission of cuts for review for all substitutions, clearly indicate Specification Section, provide complete information on the original product and the proposed product for review, and all deviations.
 - a. Designs are based on a particular manufacturer as shown on the drawing. The structural design, equipment layout, electric systems, gas piping, efficiencies, rebates and aesthetic considerations, are based upon the manufacturer shown on the drawings. While other manufacturers equipment which is mentioned in the specifications may have the same output (tons, CFM, BTUH etc.) they may not have the same weight, dimensions, efficiencies or electrical or gas requirements. Therefore, if ANY equipment is submitted OTHER THAN those models shown ON THE DRAWINGS, the contractor shall be required to pay for ALL designs, material, labor and equipment required to modify structure, equipment layout, electric, gas, aesthetic, efficiencies (including extra operating costs over a 25 year period) and rebates which are incurred by using said equipment.

C. Samples:

1. Provide Samples of items scheduled to be exposed in the final structure.
2. When specifically so requested by the Contractor and permitted by the Engineer, authorized samples will be returned to the Contractor for installation in the Work.

D. Shop Drawings:

1. Before fabrication or purchase of any work, major equipment or controls, prepare and submit for review, shop drawings of ductwork and major equipment in accordance with "General Conditions". Include all fire dampers, access provisions, etc. Coordinate all of the above with all other trades.
2. Prepare and submit Shop Drawings, showing at a scale not smaller than $\frac{1}{4}'' = 1'-0''$ all details of items to be shop fabricated under this Section. Maximum sheet size 30" x 42".
3. Clearly identify by circle and by note "DEVIATION" and by note "INTERFERENCE", in large bold lettering, and deviations from Drawings and Specifications and any potential or unresolved interference condition and assume full responsibility for failure to do so.
4. Submittal shall confirm fabrication and installation is in accordance with recommendations and applicable standards.
5. For mandatory coordination of all work, including that which penetrates structural members, consult General Conditions.

- E. Installation Requirements: Furnish and erect all ductwork, hangers, dampers, and all accessories specified, indicated on the drawings or required to assure proper operation of all systems installed under this Section and of all connected equipment furnished under other Sections of these Specifications but requiring services furnished under this Section.

- F. Manuals: Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the Engineer four copies of an operation and maintenance manual compiled in accordance with the provisions of the General Conditions, and these Specifications. Include in each manual:
 1. Copy of the authorized Record Documents of this portion of the Work.
 2. Copies of all warranties and guarantees.
- G. As-built Drawings (maintain in accordance with "General Conditions"): Concurrent with the progress of the Work, the Contractor shall maintain a set of as-built record prints noting in red all changes in the Work. Upon completion of the Work this marked up set of prints is to be turned over to the Owner for his records.
- H. All required permits, fees and inspections shall be arranged and paid for by the Contractor. The Contractor shall present to the Owner, properly signed, all required certificates of final inspection and authorization before the Work will be accepted as complete.

1.5 PRODUCT HANDLING

- A. General Protection: Do not allow equipment, insulation material, or associated items to become wet, soiled or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide only materials that are new, of the type and quality specified. Where no standards have been established for such materials, provide only materials bearing the UL Label.

2.2 RECTANGULAR DUCTWORK

- A. Sheet metal construction shall conform to this Section and applicable requirements of:

SMACNA 15D	High Pressure Duct Construction Standards
SMACNA 15D	Low Pressure Duct Construction Standards
SMACNA	Ducted Electric Heat Guide for Air Handling Systems
SMACNA	Fire Damper Guide for Air Handling Systems.
- B. Except where noted otherwise, sheet metal ductwork shall be constructed of galvanized steel sheets, ASTM A525, A527 and A90.
- C. Ductwork shall be detailed and fabricated to keep resistance losses to a minimum. Provide double thickness airfoil type turning vanes for square elbows and use gradual transformations and offsets. Where radius type elbows are used, minimum throat radius shall be equal to the duct width.
- D. Duct, plenum and casing access doors, whether or not shown on the Drawings, shall be provided for access to control and indicating instruments, dampers, both sides of coils and filters and to any other device requiring inspection or maintenance. Hardware shall be as manufactured by Ventfabrics, Inc. or authorized equal.
- E. Provide splitter dampers to adjust the air volume in the branch ductwork of all duct systems. Dampers shall have an indicating and locking device. Dampers in rectangular ductwork shall be

blade type. Provide single blade damper up to 12" size and opposed blade type dampers in ducts over 12" size. Damper construction shall be as recommended in the applicable SMACNA duct manual.

- F. Provide test openings with covers for taking pressure and velocity readings as required for balancing and adjusting the air system.
- G. Fans and air handling units shall be isolated from ductwork and casings with waterproof and fire resistant fabric connections, Ventfabrics Inc. or authorized equal. Connectors shall have minimum of 3" between metal ends with approximately 1-1/2" of slack and shall be arranged to prevent vibration transmission from fans and units to the ductwork or casing.
- H. Rectangular ductwork shall be constructed in accordance with SMACNA LP Duct Manual and SMACNA Standards 15d for minimum of 2" W.G. static pressure positive, and 2" W.G. negative, including metal gauges, reinforcing, fittings, connections, access doors and other accessories.
- I. Where space permits, duct elbows shall have a centerline radius and 1-1/2 times the dimensions of the duct in the plane of the bend. Where space does not permit use of this radius, a minimum radius of 1.25 may be used without using concentric splitters, or else turning vanes with square elbows shall be used. Turning vanes shall be of the double walled type of Tuttle & Bailey, or authorized equal make, spaced in accordance with duct size.

Shop fabricated turning vanes may be submitted for authorization before erection. Ducts up to 13" deep shall have 2" radius blades on 2" centers, ducts from 13" to 24" shall have 3" radius blades on 3" centers. Where concentric splitters are used, the radii of the bends shall be carefully located for low loss elbows. All elbows shall be made to produce no greater air resistance than elbow with 1.25 radius.

- J. Interior of return air duct shall be painted black at areas inside return air grilles only.

2.3 ROUND AND OVAL DUCTWORK

- A. Provide double-wall, internally insulated factory fabricated equal to United McGill Corp., United Sheet Metal Division, Acousti-k27, thermal conductivity 0.27 BTU/hr./SF/Deg. F at 75° F. Except where noted otherwise, sheet metal ductwork shall be constructed of galvanized steel sheets, ASTM A527-67.
- B. Branch connections shall be conical tees or laterals. Straight tees or laterals will not be permitted.
- C. Round ductwork and fittings shall have lock type spiral construction.
- D. Insulation shall be minimum 1" thick. Flame spread 10-20, fuel contributed 10-15, smoke developer 0-20, all per UL ratings.
- E. Joints in round and oval ductwork shall be designed to be airtight without the use of tape. Total allowable duct leakage shall conform to Section 4.06 of these specifications.
- F. Sheet metal construction shall conform to this Section and applicable requirements of:
 - SMACNA 15D High Pressure Duct Construction Standards
 - SMACNA 15D Low Pressure Duct Construction Standards
 - SMACNA Ducted Electric Heat Guide for Air Handling Systems

- G. Provide splitter dampers to adjust the air volume in the branch ductwork of all duct systems. Dampers shall have an indicating and locking device. Dampers in rectangular ductwork shall be blade type. Provide single blade damper up to 12" size and opposed blade type dampers in ducts over 12" size. Damper construction shall be as recommended in the applicable SMACNA duct manual.
- H. Provide test openings with covers for taking pressure and velocity readings as required for balancing and adjusting the air system.
- I. Fans and air handling units shall be isolated from ductwork and casings with waterproof and fire resistant fabric connections, Ventfabrics Inc. or authorized equal. Connectors shall have minimum of 3" between metal ends with approximately 1-1/2" of slack and shall be arranged to prevent vibration transmission from fans and units to the ductwork or casing.

2.4 FLEXIBLE DUCTWORK

- A. Flexible ductwork may be used for heating/cooling, exhausting or cooling only applications and shall be as manufactured by Thermoflex, Wiremold, Genflex, or authorized equal. Duct shall be continuous and insulated with 1" thick fiberglass insulation having an outer moisture barrier consisting of a reinforced metallized Mylar/Neoprene laminate with integral attaching devices. Minimum pressure rating shall be 6" W.G. positive and 1" W.G. negative. Operating temperature range shall be -20 to +250° F. Thermal conductance: 0.23 BTU/hr/SF/°F at 75° F.
- B. Duct shall be UL listed under UL-181 as Class I Air Duct and shall be IMC authorized for installation in ceiling return air plenum.
- C. Use flexible ductwork to connect rigid sheet metal elbow at supply registers to metal supply ductwork. Install using maximum length of 5 feet of flexible ductwork with minimum centerline radius of bends not less than twice duct diameter and with no more offsets than an equivalent 90 degree elbow. Provide band strap hangers with saddle supports under flexible duct runs to keep supports from sagging. Stretch duct enough to smooth out internal corrugations.
- D. Connect flexible ductwork to collars of rigid ductwork and air delivery devices with locking clamps and "3M Brand" EC800 tape or authorized equal.

2.5 DUCTWORK ACOUSTIC LINING

- A. Acoustical lining shall consist of 1" mat faced fiberglass duct liner for supply and return ducts from air handling units and/or fans, applied with special cement and adhered clips and washers. The surface shall be properly sized with flexible waterproof sizing brushed on the material to keep it permanently in place. All acoustical lining shall be applied in accordance with the manufacturer's instructions and local code requirements. All supply and return ductwork shall be acoustically lined. Duct sizes shown on the drawings are free area which shall be the actual inside dimensions after application of acoustical liner.
- B. Apply duct liner with coated side facing air stream and secured to the sheet metal with "ED104" adhesive or with mechanical clips recommended by the manufacturer.

- C. Line with one of the following 1” thick materials: CSG No. 300, coated, PPG 3 pcf, Superfine or Textrafine Fiberglass PF-615, Johns-Manville 3 pcf Micortex coated duct liner, or equal.
- D. Duct sizes indicated on drawings are clear inside dimensions. Increase sheet metal sizes as required to install acoustic lining.
- E. The following ductwork shall be acoustically lined whether or not shown on drawings.
 - 1. All supply and return ductwork and all branches from air handling units not less than 20 ft. from supply duct exit and 20 ft. from return duct entrance shall have 1” thick lining.
 - 2. Where shown on drawings.
- F. Where acoustic lining is used, external insulation required by this section may be eliminated for that portion of the ductwork except for outdoor ductwork.

2.6 INTERIOR DUCTWORK INSULATION

- A. Provide insulation for all concealed supply ductwork and all outside air ductwork. Ductwork located in hung ceiling, mechanical, and plenum spaces shall be considered concealed.
- B. Insulate with a flexible fiberglass insulation. "Ductwrap", 1.5" thick, 3/4 pound per cubic foot density, "K" value at 75° F, maximum 0.26 BTU/HR/SF/degrees F/HR with factory applied reinforced multi-purpose foil-skrim-kraft (SFK) aluminum foil vapor barrier and vinyl covered for systems conveying air at less than room temperature.
- C. Insulation for concealed ductwork shall be secured to the ductwork with adhesive, Benjamin Foster 81-91, or authorized equal. Apply adhesive in strips with a minimum 50% coverage. Seal all joints with 3" wide strips of the facing material applied using Benjamin Foster 81-91 on both surfaces.
- D. Acceptable Manufacturers:
 - 1. Certainteed Corp., Valley Forge, PA
 - 2. Owens-Corning Fiberglas Corp., Toledo, OH
 - 3. Armstrong Cork Co., Lancaster, PA
- E. Adhesives and insulation materials: composite fire and smoke hazard ratings maximum 25 for Flame Spread and 50 for Fuel Contributed and Smoke Developed. Adhesives to be waterproof.

2.7 RETURN AND EXHAUST REGISTERS

- A. Provide return and exhaust grilles of the horizontal face bar type, 35 degree deflection unless otherwise noted with volume dampers, Titus or authorized equal.

2.8 CEILING SUPPLY DIFFUSERS

- A. Provide square architectural ceiling supply diffusers, horizontal pattern, three corner 24 gauge steel with round necks, 5/16", steel 24" x 24", with equalizing grid Titus OMNI or authorized equal.

2.9 FIRE DAMPERS

- A. Fire dampers and sleeve installation shall be in accordance with NFPA_90A recommendations and shall bear U.L. Label in compliance with U.L. 555.

- B. Clearly indicate fire damper location on shop drawings. Provide access doors in the ducts and furnish access doors or panels at building construction at each damper of sufficient size and type to permit inspection and replacement of linkage. Assume responsibility to coordinate all locations of duct access doors with the General Contractor to conform with whatever architectural access openings may be necessary and furnish access doors or panels in building construction. Provide shop drawings indicating location of access panels or doors for Architect's approval.
- C. It is the intention of these plans and specifications to be complete. However, it is the responsibility of this Section, as being completely cognizant of local regulations, to determine where fire dampers are required and to advise the Architect prior to construction as to any discrepancies or questions in the plans or specifications.
- D. Fire dampers shall be enclosed in sleeve of fourteen gage metal set and grouted into fire partitions. Sleeve shall be secured at both sides of fire partitions with 1-1/2 x 1-1/2 x 1/4 ga. mounting angles secured to sleeves only. Provide duct breakaway connections, see detail on drawings.
- E. It is the intention of these plans and specifications to be complete. However, it is the responsibility of this section as being completely cognizant of local regulations, to determine where fire dampers are required and to advise the Architect prior to construction as to any discrepancies or questions in the plans of specifications.

Furnish fire dampers if not already required by regulations as listed below:

At each penetration of shaft wall.

At each penetration of a required fire partition or fire wall.

At each penetration of rated floor/slab or floor/ceiling assembly.

- F. Fire dampers shall be "Fire Seal" as made by Air Balance, Inc. or approved equal, U.L. labeled.

Used For	Fire Damper
Rectangular Square	Type B
Low Pressure Ductwork	Model 119BL
Low, Medium or High	Type C
Pressure Round Duct	Model 119-CL

2.10 ACCESS DOORS IN SHEET METAL WORK

- A. Wherever necessary in ductwork, casings or sheet metal partitions, provide suitable access doors and frames to permit inspections, operation and maintenance of all valves, coils, humidifiers, controls, smoke dampers, smoke detectors, fire dampers, filters, bearings, traps, or other apparatus concealed behind the sheet metal work. All such doors shall be of double construction of not less than No. 20 gauge sheet metal and shall have sponge rubber gaskets around their entire perimeter. Doors in insulated ducts of insulated casings shall have rigid fiberglass insulation between the metal panels.

- B. All access doors in sheet metal ducts shall be hung on heavy flat hinges and shall be secured in the closed position by means of cast zinc clinching type latches. Where space conditions preclude hinges, use four heavy window type latches. Doors into ducts shall in general not be smaller than 18" x 18" except for access door to fire dampers which will depend on size of fire damper.
- C. In no case shall access to any items of equipment requiring inspection, adjustment, or servicing require the removal of nuts, bolts, screws, wing nuts, wedges, or any other screwed or loose device.
- D. Each sheet metal chamber shall have access doors for access to all parts of the system. Doors shall be fitted with cast zinc door latches, two per door. Latches shall be operable from both sides of casing. Hinges shall be extra heavy, zinc plated hinges, minimum of two per door. The doors shall be felted or provided with rubber gaskets so as to make them air-tight. The doors shall be made with inner and outer shells 2 inches apart so that they may be properly insulated and properly operated. Doors shall be a minimum size of 20" x 48".
- E. Hinges shall be Ventlok No. 150 or 260 with or without screw holes or approved equal. Latch or walk-in access doors shall be No. 260 as made by Ventlok Co. or approved equal. Latch for access door in ductwork shall be Ventlok No. 100 or approved equal.

2.11 PIPING

- A. A/C unit drain: Type "L" copper pipe with wrought copper 95-5 soldered fittings.
- B. Refrigerant: ACT copper tubing with 300 lb. brazed fittings.
- C. Provide dielectric connects between pipe materials
- D. Combustion air and combustion exhaust shall be schedule 40 CPVC pipe.

2.12 PIPE INSULATION

- A. All insulation shall have composite (insulation, jacket facing and adhesive used to adhere jacket or facing to the insulation) fire on smoke hazard ratings as testing by Procedure ASTM E-84, NFPA 255 and UL 73 not exceeding flame spread of 24, fuel contributed of 50 and smoke developed of 50. Accessories such as adhesives, mastics, cements, tapes and clothes for fittings shall have component ratings as listed above.
- B. The Materials as specified below have been selected from the catalog of Armacell Corporation and are representative of the quality, design and finish as desired. Insulation as manufactured by other manufacturers may be submitted for approval, provide the products meet fully in all respects (such as density, moisture absorption, alkalinity thermal-conductivity jacket, etc.) to the materials as delineated below.
- C. Insulate all refrigerant piping with 1" thick Armaflex.
- D. Insulate all condensate piping with ½" thick Armaflex.

PART 3 - FANS AND HVAC EQUIPMENT

3.1 GENERAL REQUIREMENTS

- A. The following requirements apply in general to all equipment specified. Certain items may not appropriately apply to every piece of equipment.
- B. Provide required copies of manufacturers catalog or data sheets for each piece of equipment showing illustrations, details, sizes, dimensions, performance characteristics, wiring diagrams, controls and other pertinent details.
- C. All main service supplies shall match the characteristics in the Drawings.
- D. All equipment wires, and electrical fittings shall be copper only.
- E. All motors shall be built and tested in accordance with the latest standards of NEMA, ANSI, IEEE and the National Electric Code, as applicable, and shall be energy efficient motors of NEMA Design A or B. Minimum motor full load power factor shall be 85%. Motors shall be capable of a minimum 20 second stall at locked rotor without damaging the insulation or windings.
- F. Based on 1800 RPM, 3 phase operation for all HVAC equipment, motors shall be guaranteed by the motor manufacturer and when tested in accordance with IEEE Test #112A, Method B, shall be as follows:

TEFC HORSEPOWER RATING	DRIP PROOF EFFICIENCY	EFFICIENCY
1 - 3	86.5%	88.5%
3	86.5%	88.5%
5	87.5%	88.5%
7 1/2 - 10	89.5%	91.0%
15 - 20	91.0%	91.7%
25 - 40	93.0%	93.0%
50 - 75	94.1%	94.5%

- G. Provide gaskets installed to prevent leakage between each filter and between the filter and its supporting frame. Filter efficiencies shall be average atmospheric dust spot efficiencies tested in accordance with ASHRAE Standard 52-76.
- H. Fans shall be tested and rated in accordance with the applicable AMCA Standard Test Code and Certified Ratings Program, and shall bear the AMCA Certified Rating Seal.
- I. Motor drives shall be protected by belt guards furnished by the equipment manufacturer in accordance with SMACNA and OSHA requirements.

3.2 SPLIT SYSTEM AIR COOLED CONDENSING UNITS

- A. The contractor shall furnish and install air-cooled condensing units as shown as scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.
- B. Base Bid shall be Lennox air-cooled condensing unit with approved alternate being. Alternates must still comply with the performance and features as specified with these specifications and as

indicated on the design documents. Job will be awarded on basis of specified product. Substitutions must be selected and approved within 14 calendar days after award of contract.

- C. Provide self-contained, packaged, factory-assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressor(s), condensing coil and fans, integral subcooling circuits, filter drier(s) and controls. Provide expansion valves for split system units.
- D. Performance Ratings: Energy Efficiency Rating (EER) 13.
- E. House components in 18 gauge zinc-coated galvanized steel frame and panels with weather resistant, baked enamel finish. Units surface shall be tested 500 hours in salt spray test.
- F. Mount controls in weatherproof panel provided with removable panels and/or access doors with quick opening fasteners.
- G. Coils: Aluminum fins mechanically bonded to seamless copper tubing. Provide subcooling circuit(s). Factory leak test under water to 450 psig, and vacuum dehydrate. Seal with holding charge of nitrogen.
- H. Vertical discharge direct driven propeller type condenser fans with fan guard on discharge. Fans shall be statically and dynamically balanced.
- I. Weatherproof motors suitable for outdoor use, with permanently lubricated totally enclosed or open construction motors shall be provided and shall have built in current and thermal overload protection. Motors shall be either sleeve or ball bearing type.
- J. Compressor(s): Provide direct-drive hermetic, reciprocating type compressor(s) with centrifugal oil pump providing positive lubrication to moving parts and automotive type pistons, rings to prevent gas leakage, internal suction and discharge valves and crankcase heater. Motor shall be suction gas-cooled with internal temperature and current sensitive motor overloads. Internally isolated motors on springs. External high and low pressure cutout devices shall be provided.
- K. Provide factory-wired condensing units with 24 volt control circuit with internal fusing and control transformers, contactor pressure lugs and/or terminal block for power wiring. Contractor to provide field installed unit mounted disconnect switch. Units shall have single point power connections.
- L. Provide factory-wired units with 24-volt electro-mechanical control circuit with control transformers, contactors pressure lugs or terminal block for power wiring. Field wiring of zone controls to be NEC Class II.

3.3 CONDENSING GAS FURNACES AND "A" COILS

- A. Convertible Condensing Gas Furnace with direct vent and Untized casing with Single Door Filter
- B. Blower doors shall be gasketed and insulated 1/4 Turn Perfect Fit Style Door Latches and have a blower door safety switch
- C. Multi position Internal Filter Rack with 1 inch Cleanable high velocity filters.
- D. Upflow-convertible to horizontal left return air inlet capability.

- E. Type 29-4C stainless steel secondary heat exchanger.
- F. Direct drive 4-speed motors with speed selected at the furnace for heating and cooling.
- G. Silicon Nitride igniter ignition system for flame proving through the microprocessor.
- H. Quiet induced draft blower, Dual solenoid combination gas valve and regulator.
- I. PVC venting-1 or 2 pipe option, Left or right gas connection, and ICS AFUE 92%.
- J. Selectable cooling fan off delay eliminates need for time delay relay.
- K. Integrated solid state control with self diagnostics, 24 volt fuse, and Manual reset burner box limit.
- L. Provide matched ARI rated "A" Coil to mate with the furnace as it is arranged on the drawings.

3.4 ELECTRIC WALL HEATERS

- A. Wall heaters shall consist of a sheathed, finned heating element, fan and protective grille in a box for recessed or surface mounting. The unit shall have automatic resetting thermal protection to protect against overheating and a manual switch for disconnecting power supply. Unit shall be controlled by an integral thermostat with concealed adjustment. Fan motor shall be permanently lubricated, totally enclosed. A fan delay switch shall maintain fan in operation until thermal element cools and prevent fan operation until coil is hot. Unit shall operate on 208 volts.

3.5 EXHAUST FANS

- A. This Contractor shall provide all fans where indicated on the Drawings, and shall provide all starters, relays and other control devices for installation by "Electrical".
- B. Fans shall be furnished complete with birdscreen, back draft dampers and curbs.
- C. Fans shall be of the size, type and manufacturer as indicated on the Drawings.

3.6 MOTOR STARTERS

- A. Furnish motor starters for every item which requires a starter, furnished under this Section.

3.7 VARIABLE REFRIGERANT SYSTEM HEAT PUMPS

- A. The variable capacity, heat pump air conditioning system shall be a Daikin Variable Refrigerant Volume Series split system as specified. The system shall consist of multiple evaporators, REFNET™ joints and headers, a two-pipe refrigeration distribution system using PID control, and Daikin VRV® outdoor unit. The outdoor unit is a direct expansion (DX), air-cooled heat pump, multi-zone air-conditioning system with variable speed driven compressors using R-410A refrigerant. The outdoor unit may connect an indoor evaporator capacity up to 200% of the outdoor condensing unit capacity. All zones are each capable of operating separately with individual temperature control.
- B. The Daikin outdoor unit shall be interconnected to indoor unit models as scheduled in accordance with Daikin's engineering data book detailing each available indoor unit.

The indoor units shall be connected to the outdoor utilizing Daikin's REFNET™ specified piping joints and headers.

- C. Operation of the system shall permit either cooling or heating of all of the fan coil units. Each fan coil or group of fan coils shall be able to provide set temperature independently via a local remote controller, an Intelligent Controller, an Intelligent Manager or a BMS interface.

D. VRV IVS FEATURES AND BENEFITS

1. Voltage Platform – Heat pump condensing units shall be available with a 208V/1/60 power supply.
2. Advanced Zoning – A single system shall provide for up to 10 zones.
3. Auto charging – Each system shall have a refrigerant auto-charging function.
4. Charge Checking – Each system shall have a refrigerant charge checking function.
5. Defrost Heating – Each system shall maintain continuous heating during defrost operation.
6. Independent Control – Each fan coil shall use a dedicated electronic expansion valve for independent control.
7. VFD Inverter Control – Each condensing unit shall use a high efficiency, variable speed “inverter” compressor coupled with inverter fan motors for superior part load performance. Compressor capacity shall be modulated automatically to maintain a constant suction pressure, while varying the refrigerant volume for the needs of the cooling or heating loads. Indoor fan coil units shall use PID control to control superheat to deliver a comfortable room temperature condition.
8. Flexible Design –
 - a. Systems shall be capable of up to 540ft (640ft equivalent) of linear piping between the condensing unit and furthest located fan coil unit.
 - b. Systems shall be capable of up to 3,280ft total “one-way” piping in the piping network.
 - c. Systems shall have a vertical (height) separation of up to 295ft between the condensing unit and the fan coil units.
 - d. Systems shall be capable of 295ft from the first REFNET™ / branch point.
 - e. The outdoor unit shall connect an indoor evaporator capacity up to 200% of the outdoor condensing unit capacity.
 - f. Systems shall be capable of 49ft between fan coil units.
 - g. Condensing units shall be supported with a fan/fan motor ESP up to 0.32” WG as standard to allow connection of discharge ductwork and to prevent discharge air short circuiting.
9. Simple Wiring – Systems shall use 16 AWG, 2 wire, multi-stranded, non-shielded and non-polarized daisy chain control wiring.
10. Energy Efficiency – System shall have equivalent or better performance than high efficiency air cooled or water cooled chiller systems.

11. Advanced Diagnostics – Systems shall include a self-diagnostic, auto-check function to detect a malfunction and display the type and location.
12. Advanced Controls – Each room shall have at least one BRC1E71 wired remote controller capable of controlling all the fan coil units in the room. The systems shall be integrated via DES601C71 & DCS601A72 I-Touch controller and BACnet building management systems.
13. Low Sound Levels – Each system shall use indoor and outdoor units with quiet operation as low as 29 dB(A).

E. WARRANTY

The units shall have a manufacturer's warranty for a period of one (1) year from date of installation. The units shall have a limited labor warranty for a period of one (1) year from date of installation. The compressors shall have a warranty of six (6) years from date of installation. During the stated period, should any part fail due to defects in material and workmanship, it shall be repaired or replaced at the discretion of Daikin AC (Americas), Inc. according to Daikin's terms and conditions. All warranty service work shall be performed by a Daikin factory trained service professional.

F. INSTALLATION REQUIREMENTS

The system must be installed by a Daikin factory trained contractor/dealer. The bidders shall be required to submit training certification proof with submittals. The mechanical contractor's installation price shall be based on the systems installation requirements. The mechanical contractor bids with complete knowledge of the HVAC system requirements

G. OUTDOOR UNIT

1. The outdoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of Daikin scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports and refrigerant regulator. High/low pressure gas line, liquid and suction lines must be individually insulated between the outdoor and indoor units.
2. The outdoor unit can be wired and piped with outdoor unit access from the left, right, rear or bottom.
3. The connection ratio of indoor units to outdoor unit shall be permitted up to 200%.
4. Each outdoor system shall be able to support the connection of up to 41 indoor units dependent on the model of the outdoor unit.
5. The sound pressure level standard shall be that value as listed in the Daikin engineering manual for the specified models at 3 feet from the front of the unit. The outdoor unit shall be capable of operating automatically at further reduced noise during night time.
6. The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for reprogramming.

7. The unit shall incorporate an auto-charging feature and a refrigerant charge check function.
8. The outdoor unit shall be modular in design and should allow for side-by-side installation with minimum spacing.
9. The following safety devices shall be included on the condensing unit; high pressure switch, control circuit fuses, crankcase heaters, fusible plug, high pressure switch, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
10. To ensure the liquid refrigerant does not flash when supplying to the various fan coil units, the circuit shall be provided with a sub-cooling feature.
11. Oil recovery cycle shall be automatic occurring 2 hours after start of operation and then every 8 hours of operation.
12. The outdoor unit shall be capable of heating operation at 0°F dry bulb ambient temperature without additional low ambient controls.
13. The system shall continue to provide heat to the indoor units while in the defrost mode.
14. The outdoor unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.
15. Fan:
 - a. The condensing unit shall consist of one or more propeller type, direct-drive 750 W fan motors that have multiple speed operation via a DC (digitally commutating) inverter.
 - b. The condensing unit fan motor shall have multiple speed operation of the DC (digitally commutating) inverter type, and be of high external static pressure and shall be factory set as standard at 0.12 in. WG. A field setting switch to a maximum 0.32 in. WG pressure is available to accommodate field applied duct for indoor mounting of condensing units.
 - c. The fan shall be a vertical discharge configuration with a nominal airflow maximum range of 6,530 CFM to 14,120 CFM dependant on model specified.
 - d. The fan motor shall have inherent protection and permanently lubricated bearings and be mounted.
 - e. The fan motor shall be provided with a fan guard to prevent contact with moving parts.
 - f. Night setback control of the fan motor for low noise operation by way of automatically limiting the maximum speed shall be a standard feature. Operation sound level shall be selectable from 3 steps as shown below.
16. Condenser Coil:
 - a. The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.

- b. The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure high efficiency performance.
 - c. The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tube with N-shape internal grooves mechanically bonded on to aluminum fins to an e-Pass Design.
 - d. The fins are to be covered with an anti-corrosion acrylic resin and hydrophilic film type E1.
 - e. The pipe plates shall be treated with powdered polyester resin for corrosion prevention. The thickness of the coating must be between 2.0 to 3.0 microns.
17. Compressor:
- a. The Daikin inverter scroll compressors shall be variable speed (PAM inverter) controlled which is capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure as measured in the condensing unit. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity (INV frequency or STD ON/OFF) shall be controlled to eliminate deviation from target value.
 - b. The inverter driven compressor in each condensing unit shall be of highly efficient reluctance DC (digitally commutating), hermetically sealed scroll “G-type” with a maximum speed of 7,980 rpm.
 - c. Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type. At complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.
 - d. The capacity control range shall be as low as 6% to 100%.
 - e. Each non-inverter compressor shall also be of the hermetically sealed scroll type.
 - f. Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.
 - g. Oil separators shall be standard with the equipment together with an intelligent oil management system.
 - h. The compressor shall be spring mounted to avoid the transmission of vibration.
18. Electrical
- a. The power supply to the outdoor unit shall be 208 volts, 1 phase, 60 Hertz +/- 10%.
 - b. The control voltage between the indoor and outdoor unit shall be 16VDC non-shielded, stranded 2 conductor cable.
 - c. The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one outdoor unit with one 2-cable wire, thus simplifying the wiring operation.

H. INDOOR UNIT – CEILING CASSETTE UNIT

- 1. General: The indoor unit model shall be a nominal 2’x2’ ceiling cassette fan coil unit, operable with R410A refrigerant, equipped with an electronic expansion valve, for installation into the ceiling cavity equipped with an air panel grille. It shall be available from 7,500 Btu/h to 18,000 Btu/h. to be connected to outdoor unit model heat pump. It shall be a four-way air distribution type, ivory white, impact resistant, and washable decoration panel. The supply air is distributed via motorized louvers which can be horizontally and vertically adjusted from 0° to 90°.

Computerized PID control shall be used to maintain room temperature within 1°F. Equipped with a programmed drying mechanism that dehumidifies while inhibiting changes in room temperature. The indoor units sound pressure shall range from 28 dB(A) to 33 dB(A) at low speed measured at 5 feet below the unit.

2. Indoor Unit:

- a. The indoor unit shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
- b. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
- c. Both refrigerant lines shall be insulated from the outdoor unit.
- d. The 4-way supply air flow can be field modified to 3-way and 2-way airflow to accommodate various installation configurations including corner installations.
- e. Return air shall be through the concentric panel, which includes a resin net mold resistant filter.
- f. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 21” of lift.
- g. The indoor units shall be equipped with a return air thermistor.
- h. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
- i. The voltage range will be 253 volts maximum and 187 volts minimum.

3. Unit Cabinet:

- a. The cabinet shall be space saving and shall be located into the ceiling.
- b. Three auto-swing positions shall be available to choose, which include standard, draft prevention and ceiling stain prevention.
- c. The airflow of the unit shall have the ability to shut down one or two sides allowing for simpler corner installation.
- d. Fresh air intake shall be possible by way of Daikin’s optional fresh intake kit.
- e. A branch duct knockout shall exist for branch ducting supply air.
- f. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

4. Fan:

- a. The fan shall be direct-drive turbo fan type with statically and dynamically balanced impeller with high and low fan speeds available.
- b. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range from 0.06 to 0.12 HP.
- c. The air flow rate shall be available in high and low settings.
- d. The fan motor shall be thermally protected.

5. Filter:

- a. The return air shall be filtered by means of a washable long-life filter with mildew proof resin.

6. Coil:

- a. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
- b. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.

- c. The coil shall be a 2 row cross fin copper evaporator coil with 17 FPI design completely factory tested.
 - d. The refrigerant connections shall be flare connections and the condensate will be 1 - 1/4 inch outside diameter PVC.
 - e. A condensate pan shall be located under the coil.
7. Electrical:
- a. A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range should be 187 to 253 volts.
 - b. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
 - c. Transmission (control) wiring between the indoor and remote controller shall be a maximum distance of 1,640 feet.

PART 4 - AUTOMATIC TEMPERATURE CONTROLS

4.1 SPLIT SYSTEM and ROOFTOP UNIT CONTROLS

- A. Each split system and rooftop unit shall be controlled by Lennox CS 7500 Series 7 day Programmable Thermostat with locking cover to accomplish the following temperature control and energy conservation strategies.
 - 1. Occupied Mode - All unit functions will be enabled for normal heating and cooling operation. Sensors to average zone temperature will require 4 sensors per system. One of the sensors will be in the thermostat.
 - 2. Occupied Space Temperature Control - When in occupied mode as described above, the dedicated unit control shall open the motorized damper on the fresh air intake to each unit and operate stages of heating and cooling to maintain space temperature set point. Set points shall be set locally through the thermostat by the occupant.
 - 3. Unoccupied Setback Temperature Control-When in the unoccupied mode, the unit shall be fresh air damper shall remain closed.
- B. Each thermostat shall be furnished with a remote temperature sensor if owner decides to move the control to a central location.

PART 5 - EXECUTION

5.1 TEMPORARY HEAT, POWER AND LIGHTING

- A. Provide temporary heat to allow all sections to work unencumbered at a temperature minimum of 55° F, 24/7. Heating equipment and fuel source shall be independent of the Owner's system and shall be at the expense of this contractor only. Owner's heating system and fuel source shall not be used during construction.
- B. It is the Contractor's responsibility to run power from point of availability as provided in the Electrical Contract, to the point of use. Provide local temporary lighting as required for performance of the work in this section.

5.2 EXISTING CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

5.3 PREPARATION

- A. Coordination:
 - 1. Coordinate as necessary with other Sections to assure proper and adequate provision in the work of those Sections for interface with the work of this Section.
 - 2. Coordinate the installation of air distribution items with the schedule for work of other trades to prevent unnecessary delays in the total work.
 - 3. Where ductwork and other air distribution items are shown in conflict with locations of structural members and mechanical or other equipment, provide required supports and ductwork to clear the encroachment.
 - 4. Coordinate fire damper locations and sizes with trades responsible for constructing the walls, floors and ceilings in which they are to be mounted.
 - 5. Demolition: Contractor shall perform all demolition of the existing installation as required to complete construction as indicated on the Drawings. Coordinate all work with Owner.
- B. Data indicated on the Drawings and in these Specifications are intended to convey the Engineer's intentions only; as such their accuracy is not warranted. The exact locations, distances, levels, and other conditions will be governed by actual construction and the Drawings and Specifications should be used only for guidance in such regard.
- C. Where devices are not specifically located on the Drawings, locate as determined in the field by the Architect or Engineer. Where devices are installed without such specific direction, relocate as directed by the Architect or Engineer, at no additional cost to the Owner.
- D. Verify all measurements at the site. No extra compensation will be allowed because of differences between work shown on the Drawings and actual measurements at the site of construction.
- E. Provide all cutting and patching, fire caulking and sealing to standards of applicable Sections of these Specifications.
- F. The HVAC Drawings are diagrammatic, but are required to be followed as closely as actual construction and work of other Sections will permit. Where deviations are required to conform with actual construction and the work of other Sections, make such deviations without additional cost to the Owner.

5.4 INSTALLATION

- A. Ductwork and Register Installation:
 - 1. Ductwork shall be suspended or supported in accordance with SMACNA, latest edition.
 - 2. Unless indicated otherwise, branch connections to the main shall be "Boot" type connections.
 - 3. Ductwork in back of registers and grilles shall be painted flat black as ductwork is being installed.
 - 4. Paint inside of all air outlets and connecting plenums with one coat of black paint, or provide all such items factory pre-painted.
 - 5. Paint exposed duct runs, to standards of the Architect.
 - 6. Cap duct openings to exclude dirt until registers and equipment are installed. Vacuum clean all ductwork prior to installation of registers, etc.

7. Clean all registers and diffusers.
- B. Sleeves or holes in masonry: Provide and install accurately dimensioned and shaped to permit passage of items of this Section.
- C. Install draft stops to seal all openings in floors and walls around piping and ductwork. Draft stops shall be neatly fitted to completely seal all openings, securely fastened to the piping, ductwork and building construction, and adequately braced, where required. Draft stop material and construction shall be in accordance with latest applicable NFPA requirements, local building codes and shall have a fire resistive rating as required by the authority having jurisdiction or of the construction penetrated, whichever is more stringent.
- D. Equipment Access
1. Install piping, equipment, doors and accessories to permit access for maintenance. Relocate items as necessary to provide such access, and without additional cost to Owner.
 2. Provide access doors for installation by others where valves, motors, coils; or equipment requiring access for maintenance is located in walls or above ceilings. Coordinate location of access doors with Architect and other trades as required.
 3. Provide and install access doors where required in ductwork.
- E. Pipe Supports
1. Support suspended piping with clevis or trapeze hangers and rods.
 2. Space hangers and support for horizontal steel pipes according to the following schedule:

<u>Pipe size:</u>	<u>Maximum spacing on centers:</u>
3/4" and smaller:	10'-0"
1" and greater:	12'-0"
 3. Space hangers and supports for horizontal copper tubing according to the following schedule:

<u>Tube size:</u>	<u>Maximum spacing on centers:</u>
1 1/4" and smaller:	6'-0"
1 1/2" and over:	10'-0"
 4. Paint all hangers and rods with 2 coats of an authorized Rustoleum or equal LEAD FREE product, with each coat of a different color or shade. Coordinate colors with Architect.
 5. Cast Iron Soil Pipe: at 5 foot intervals and behind every hub.
- F. Touch up scratches and abrasions to be invisible to the unaided eye from a distance of 5'-0".
- G. For electrically operated equipment, verify the electrical characteristics actually available for the work of this Section and provide equipment meeting those characteristics.
- H. Penetration Caulking: caulk all floor and wall penetrations with fire retardant material meeting ASTM 814 and UL 1479 Fire Test Standards. Metcaulk or authorized equal.
- I. Control Wiring: provide control wiring as required, to the standards and workmanship of all applicable codes.

- J. FIRE BARRIER PLASTIC PIPE CAULKING: Provide where plastic pipe penetrates a rated wall, intumescent-type sealant complying with UL Fire Resistance Directory and ULC Volume 3 Fire Resistance Ratings, UL classified for use with PVC, CPVC, CCPVC, ABS, CCABS, PVDF, PP, PB and FRPP, HILTI FS-ONE or authorized equal.

5.5 PROTECTION AND CLEANING

- A. Maintenance of Systems During Temporary Use
 - 1. Lubricate bearings in HVAC Work systems during temporary use.
 - 2. Maintain limit controls, overload devices, and safety controls in operating condition during use.
- B. Clean work furnished and installed as part of the Work, including but not limited to equipment, control panels and devices.
- C. Comply with requirements for cleaning during construction.
 - 1. Remove debris, leftover piping, tubing, ducting, metal, insulation, cartons, papers, etc., resulting from the Work.
 - 2. Remove all rust, dirt, etc., from Work to be painted and maintain in condition ready for painting.

5.6 TESTING, BALANCING AND ADJUSTING

- A. Supply and return air ductwork shall be tested during installation and before application of any exterior insulation or enclosing of the ductwork. Total leakage shall not exceed 5% of design cfm. Provide services of an independent testing and balancing agency; perform work in accordance with Associated Air Balance Council Field Measurement and Instrument form No. 12173, Volume II. All leak testing shall be done in accordance with SMACNA "HVAC AIR DUCT LEAKAGE TEST MANUAL" 15d, First Edition 1985, leakage class 12, seal class C, Table 4-1 and Appendix E for round metal duct. All outlets shall be temporarily capped and sealed securely for leak testing. Test setup shall be as per Figure 3-1 in manual.
- B. Filters:
 - 1. Assure that all filters are clean prior to conducting of any testing and balancing.
 - 2. Provide a new set of filters on all HVAC equipment prior to official opening of building.
- C. Test and adjust each piece of equipment and each system as required to assure proper balance and operation:
 - 1. Test and regulate ventilation and air conditioning systems to conform to the air volumes shown on the authorized shop drawings.
 - 2. Make tests and adjustments in apparatus and ducts for securing the proper volume and face distribution of air for each grille and ceiling outlet, test and reset each fire damper.
 - 3. Where required, provide pulleys for fans at no additional cost to the Owner, set to drive the fans at speed needed to give the indicated volume.
 - 4. For each system, take the following data in tabulated form:
 - a. Air volumes at all supply, return, and exhaust outlets;
 - b. Total cfm supplied;
 - c. Total cfm returned;
 - d. Total static pressure at each fan and at each system;
 - e. Motor speed, fan speed, and input ampere rating for each fan.
 - f. Documented changes after each trial balance.

- g. Noise level both in dba and NC, in each room.
 - h. Date of each set of data collected shall be indicated on each page of report.
 - i. Minimum CFM of outside air required by Code, CFM specified, CFM actual.
- D. Submit six (6) sets of test and balance reports to the Engineer for review and authorization.
 - E. Eliminate noise and vibration, and assure proper function of all controls, maintenance of temperature, and operation in accordance with the authorized requirements and applicable codes and standards.
 - F. Secure required authorization from governmental agencies having jurisdiction, and furnish copies of such to Owner and Architect.

5.7 INSTRUCTION AND DEMONSTRATION

- A. Prior to Final Completion, thoroughly demonstrate and instruct Owner's designated representatives in care and operation of all heating and ventilating systems and equipment provided in Heating Work Prime Contract. Provide necessary skilled labor to operate all systems for not less than 5 days and provide required instruction.
- B. In addition to Prime Contractor's instruction, arrange for technically qualified factory representatives to train Owner's representative in care, maintenance, and operation of following manufacturer's equipment and systems.
 - 1. Temperature controls.
 - 2. Central Station air handling equipment and units.
 - 3. Split system heating and air conditioning units and equipment
- C. Coordinate and schedule time and place of all training through Architect at Owner's convenience.
- D. Submit letters verifying satisfactory completion of all instruction including date of instruction, names of persons in attendance and countersigned by authorized representative of Owner.
- E. Until final acceptance, Prime Contractor retains full responsibility for systems, even though operated by Owner's personnel during instruction, unless otherwise agreed in writing.
- F. During instruction, provide list, sealed in clear plastic, outlining operating, maintenance, and starting precautions and procedures to be followed by Owner for operating systems and equipment.

5.8 GUARANTEE

- A. Guarantee all HVAC work for a period of one year after date of completion as measured from date of acceptance by the Owner. Promptly repair and make good any damage to his or the work of other Contractors or Subcontractors during that period that may be caused by defective materials or workmanship. Correct any defects in materials and workmanship without further expense to the Owner. Deliver said written guarantee at time of Owner's acceptance.

5.9 DEBRIS REMOVAL

- A. Routinely remove, in an orderly and efficient manner, (and cart away and dispose of, by legal means, off the site and premises), all debris related to work of this Section; worksite and staging areas shall be kept clear of all debris on a daily basis; permit no debris accumulation which poses any threat to

life, safety or property. Non-conformance with the foregoing Contract requirements will be subject to all remedies established by the Project General Conditions.

END OF SECTION 15600

SECTION 16000 - ELECTRICAL

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The work of this Section consists of the provision of all plant, materials, labor and equipment and the like necessary and/or required for the complete execution of all electrical work for this project, as required by the schedules and drawings, including but not limited to the following:

Note: - All holes or voids created to extend electrical systems through fire-related floors and walls shall be fire stopped.

B. Work Included:

1. New incoming electrical service rated at 120/208v 3phase 4wire – 400 amps
2. New distribution feeders.
3. New power, lighting, and distribution panel boards.
4. New MC cable branch circuits where run concealed, EMT conduit where exposed.
6. Outlets, receptacles, and switches, including porcelain and pull chain devices.
7. Power wiring of HVAC, plumbing and Owner supplied equipment.
8. Hangers, anchors, cutting, patching, pass through and watertight sleeves, chases, supports for fixtures, backboards, and other electrical materials and equipment, including fire cut offs, in association therewith.
9. Lighting fixtures, wiring, lamps and contactors.
10. Disconnects (Fused and Safety) for motors, HVAC equipment, and other equipment.
11. Motor starters for equipment including exhaust fans when not otherwise provided.
Coordinate with other trades and Owner supplied equipment vendors.
12. Temporary power and lighting for all construction and all trades.
13. Telephone/Data, mounting boards.
14. Fixtures, feeds, final connections, etc., for all exterior building mounted lighting.
15. New fire alarm system including new panel, smoke detectors, duct detectors, A/V alarms pull boxes, etc.
16. Non-Automatic transfer switch.
17. Stand-by natural gas generator and automatic transfer switch.
18. Maintenance and removal of temporary light and power.
19. Pipe sleeves and Firestopping:
 - a. Provide for all pipes, conduits and other elements passing through floors, walls, partitions and structural elements, sleeves of adequate diameter to allow for a minimum of $\frac{3}{4}$ inches clear all around sleeve and pipe. When pipe, conduit or other such element penetrates other than fire rated assembly and is insulated, insulation shall pass continuously through sleeves with $\frac{1}{2}$ inch clearance between insulation and sleeve.
 - b. Where pipes, conduits and other such elements penetrate fire rated assemblies, (walls, floors, ceilings, structure, etc.), sleeves and Firestopping systems shall be provided.
20. Furnish access doors, to the Contractor for installation where required in finished walls, partitions and the like for access to junction boxes, controls, etc., concealed behind finished construction.
 - a. Submit location drawings for approval prior to installation of same.
21. All written operating and maintenance instructions.
22. Arrange and pay for all required permits, fees and inspections.

23. Record drawings indicating all work installed or modified, contractor shall update daily or when significant amount of work is complete. Record drawings shall be maintained and ready for engineering review within 2 days notice during the entire construction period.

C. Related work included in other Sections:

1. HVAC work, under 15600.
2. Plumbing under 15400.

1.2 CODES AND QUALITY ASSURANCE

- A. The contractor shall have the work of this section performed by vendors and mechanics experienced and skilled in its implementation or by a “Specialist”, “Specialty Contractor” or “Specialty Subcontractor” under contractual agreement with the Contractor. These terms shall mean an individual or firm of established reputation, or, if newly organized, whose personnel have previously established a reputation in the same field, which is regularly engaged in, and which maintains a regular force of workmen skilled in either manufacturing or fabricating items required by the Contract, installing items required by the Contract, or otherwise performing work required by the Contract.

Where the Contract Specifications require installation by a “Specialist”, that term shall also be deemed to mean either the manufacturer of the item, an individual or firm licensed by the manufacturer, an individual or firm who will perform such work under the manufacturer’s direct supervision.

- B. The Contractor is responsible for performing all work in a neat, workmanlike manner. All operating procedures shall be strictly adhered to. Each Bidder shall visit the site and become informed as to the conditions of the premises and the extent and character of the work required. No consideration will be granted for any alleged misunderstanding of the Work to be done.
- C. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- D. All work, equipment and apparatus shall conform to the most recent requirements of the following:

New Jersey Uniform Construction Code
2018 IBC NJ International Building Code, New Jersey
ADA - Americans with Disabilities Act
State of New Jersey Barrier Free Code
NFPA 70 - National Fire Protection Association, and any other applicable NFPA standards.
2017 NEC - National Electrical Code of NFPA
NEMA - National Electric Manufacturers Association
Electrical Utility
Local Codes and Governmental Agencies
NBFU - National Board of Fire Underwriters
ANSI - American National Standards Institute
IPCEA - Insulated Power Cables Engineers Association
ASTM - American Society for Testing and Materials
UL - Underwriters' Laboratories
Requirements of the Owner's Insurance Underwriter

Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the regulations of the current editions of these codes, and the requirements of governmental agencies having jurisdiction, regardless of whether such materials and labor are called for elsewhere in these Specifications. These rules, regulations and codes shall govern as a minimum standard. In the event of conflict with the Contract Drawings or Specifications requiring workmanship or material of a higher quality than required by the above-mentioned rules, regulations, codes and authorities, the most stringent of these documents shall govern.

- E. During this work, the Contractor shall be responsible for maintaining safety among persons in his employ in accordance with the standards set by the OCCUPATIONAL SAFETY AND HEALTH ACT of 1970. The Engineer and Architect shall be held harmless for any accident, injury, or any other incident resulting from non-compliance with these or any other standards.
- F. Engineering Drawings are schematic with regard to exact locations and dimensions. Review all Drawings provided, including; Architectural and Structural Drawings, reflected ceiling plans, Plumbing, HVAC, and Electrical Drawings, to confirm all requirements and identify all constraints. The Contractor shall coordinate his work with that of all other trades to avoid conflicts. It is the Contractor's responsibility to confirm that all equipment will fit. Any discrepancies or inconsistencies are to be reported immediately to the Architect and Engineer for clarification. Refer to the actual dimensions on the Architectural Drawings and successive related shop drawings. Exact locations of diffusers, registers, thermostats, shall be directed by Architect.
- G. Examination of the site will be made by the Contractor. The Contractor will compare it with the Drawings and Specifications and will satisfy himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made for any extra expense incurred due to failure or neglect to make such examination.
- H. During the execution of work under this Contract the Contractor shall be responsible for protecting any equipment or structures in the work and adjacent areas.
- I. Secure and pay for required authorizations from governmental agencies having jurisdiction.
- J. All Work shall be guaranteed to be free from leaks or defects. Any defective materials or workmanship as well as damage to the work of all trades resulting from the same shall be replaced or repaired as directed for the duration of stipulated guarantee periods.
- K. Coordination: Each Contractor shall be responsible for coordinating their work with that of all other trades. No installation shall take place without approval of onsite entity (General Contractor, Construction Manager, etc.) responsible for coordination. Any work installed without approval and which interferes with the work of other trades that have been approved shall be removed and replaced at the Contractor's expense.
- L. Exposed piping, ductwork and conduit: EXPOSED: There shall be no exposed piping, ductwork or conduit of any sort; plumbing, fire protection, HVAC or electrical, whether implied by the MEP drawings or not, unless expressly approved by the Architect.

1.3 SUBMITTALS

- A. Shop drawings and samples shall be submitted in accordance with the requirements established in General Conditions and all other applicable documents and shall consist of the following:

- Electrical service Equipment
- Natural gas standby generator.
- Automatic Transfer Switch
- Panel Boards
- Devices
- Building Wire
- Type MC Cable
- EMT Conduit and fittings
- PVC Conduit Sch. 40 & 80 and fittings
- Rigid Steel Conduit and fittings
- Steel City J-Boxes
- Powerstrut Channel
- Plates & Covers
- Light Fixtures
- Fire Alarm Products & Drawings
- Motor Starters
- Distribution Items
- Fire stopping materials
- All basic and general materials

B. Product data: In accordance with procedures outlined in the General Conditions, submit:

1. Materials list of items proposed to be provided under this Section, with sources of supply and manufacture.
2. Manufacturers' specifications, catalog cuts and other data needed to prove compliance with the specified requirements. Include shop standards for fabrication, cuts of hangers, clips, supports, attachments, anchors, etc., labeled as to the respective conditions or locations to which they apply.
3. Product substitutions are to be requested in writing, and only in conformance with General Conditions procedures. At the time of submission of product cuts for review for all substitutions, clearly indicate the Specification Section, provide complete information on the original product and the proposed product for review, and all deviations.
 - a. Any substitutions requested by a contractor are to include all costs for related changes by other contractors. It is the responsibility of the contractor requesting the change to coordinate with any other trade impacted by the substitution.

C. Samples:

1. Provide Samples when requested by Architect.
2. When specifically so requested by the Contractor and permitted by the Engineer, authorized samples will be returned to the Contractor for installation in the Work.

D. Shop Drawings:

1. Before fabrication or purchase of any work, major equipment or controls, prepare and submit for review, shop drawings of major equipment and scale layout and design of the systems in accordance with General Conditions and Related Documents. Include all access provisions, etc. Coordinate all of the above with all other trades.
2. Prepare and submit Shop Drawings, showing at a scale not smaller than 1/4" = 1'-0" all details of items to be shop fabricated under this Section. Maximum sheet size 30" x 42".
3. Clearly identify by circle and by note "DEVIATION" and by note "INTERFERENCE", in large bold lettering, and deviations from Drawings and

Specifications and any potential or unresolved interference condition and assume full responsibility for failure to do so.

4. Submittal shall confirm fabrication and installation is in accordance with recommendations and applicable standards.
 5. For mandatory coordination of all work, including that which penetrates structural members, consult General Conditions.
- E. Installation Requirements: Furnish and erect all equipment, hangers, and all accessories specified, indicated on the drawings or required to assure proper operation of all systems installed under this Section and of all connected equipment furnished under other Sections of these Specifications but requiring services furnished under this Section.
- F. Manuals: Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the Engineer s copies of an operation and maintenance manual compiled in accordance with the provisions of the General Conditions, and these Specifications. Include in each manual:
1. Copy of the authorized Record Documents of this portion of the Work.
 2. Copies of all warranties and guarantees.
 3. Wiring diagrams & directories.
- G. Record Drawings (maintain in accordance with requirements of Section 01720 – Project Record Documents): Concurrent with the progress of the Work, the Contractor shall maintain a set of as-built record prints noting all changes in the Work. Upon completion of the Work this marked up set of prints is to be turned over to the Owner for his records.
- H. All required permits, fees and inspections shall be arranged and paid for by contractor. The Contractor shall present to the Owner, properly signed, all required certificates of final inspection and authorization before the Work will be accepted as complete.

1.4 PRODUCT HANDLING

- A. General Protection Recommendations: Do not allow equipment, insulation material, piping or associated items to become wet, soiled or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

1.5 LABELING OF PANELS AND CIRCUITS

- A. Mount a typewritten directory, show the circuit number and complete description of all outlets on each circuit. Coordinate all labeling with HVAC, Plumbing and other trades to assure uniform directory behind glass or plastic on the inside of each panel door and, on the nomenclature.
- B. On face of all panels and electrical apparatus provide black plastic laminate nametag, securely fastened, and showing complete identification.
- C. Provide 1/2" high letters on each panel and cabinets and 3/4" on switchboards, indicating voltage present.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Provide only materials that are new, of the type and quality specified. Where standards have been established for such materials, provide only materials bearing the UL Label, or complying with NEMA and NEC standards.

Product Handling: General Protection: Do not allow products and materials to become wet, soiled or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

2.2 GROUNDING SYSTEM

- A. Ground all equipment, including service entrances, switches, panelboards, conduit systems, motors, and other apparatus, by conduit or conductor to cold water main or to independent grounding electrode, using ground clamps manufactured by Burndy or T&B, and authorized by the power company and/or local code official. NOTE: EMT tubing is not acceptable as a ground path.
- B. Ground all electrical equipment in accordance with all provisions of the National Electrical Code, including lighting fixtures, motors, conduits, panelboards, transformers, and all other Non-Current carrying parts of electrical equipment.
- C. Make meg ground tests to measure ground resistance, and provide not more than 10 ohms resistance, adding ground rods as required to achieve that level. Make ground rods accessible for inspection.
- D. Interior systems equipment grounding electrode conductors shall be sized per National Electrical Code Section 250, for runs less than 100 feet. When run exceeds 100 feet, grounding conductor size shall be increased to the next larger size.
- E. Special Grounding connections for telephone system, signal systems, portable equipment and similar systems shall be as recommended by the manufacturers.
- F. Ground connections shall be made with mechanical pressure type ground clamp. O.Z., Burndy or authorized equal of proper size for the ground conductor and pipe connected. All surfaces shall be scraped clean and bright, firm mechanical connection secured and all exposed surfaces finally coated with asphaltic or glyptal paint. All ground clamps shall be equipped with compression type cable lugs, independent of the compression device clamping the pipe or rod. All grounding cable connections and splices embedded in concrete or underground shall be phosphor copper brazed and tinned or welded with the exothermic Cadweld process and wrapped with tape. Exposed connections shall be compression type to permit removal for individual ground tests. All compression connections shall have at least two studs or compression points for each conductor.
- G. Grounding conductors shall be 600 volt, type "T" green. Equipment grounding connections shall be bare copper in accordance with the latest revision of A.S.T.M. designations B3 and B8. All open, bare, grounding cable (#6 A.W.G. minimum) shall be secured in place with cast, one hole, malleable, clamps and clamp backs and bolts.
- H. All grounding connections shall be executed with the same thorough workmanship as the connections for normal current carrying parts.
- I. Ground wires shall be run in any P.V.C. conduit and sized per Article 250 of the N.E.C. Ground wires shall be terminated to the metallic enclosures of the panels, disconnects, troughs, main switchboard, and outlet boxes. For site work, provide ground conductors complete from each panel to each site connection location.

2.3 DISTRIBUTION SYSTEM

A. Identification/locations:

1. Identify all panelboards, cabinets, safety switches, and other apparatus used for operation and control of circuits, appliances, and equipment.
2. Provide plastic laminate nameplates, black face with white core letters, showing proper and complete identification.

B. Branch circuit panels: (provide for locks on all panels)

1. Provide branch circuit panels for lighting, power and general electrical service. Panels to be surface mounted, covers should not extend or project beyond box. Flush mounted panels to provide adequate overlap to completely cover electrical panel wall opening.
2. Provide panels, Eaton type Pow R Line C Pow-R-Line 3a or 4 (depending on branch breaker and main sizes), Square D, Siemens or authorized equal for over 400 Amp capacity or with over 100 Amp branch circuit.
 - a. 600 VAC or 240 VAC as indicated.
 - b. 3 phase, 4 wire, amperages as indicated, copper bus.
 - c. Main circuit breakers as indicated.
3. Low Voltage Panel, provide Eaton type Pow R Line C, Pow R Line 1, Siemens, Square D or authorized equal.
 - a. 120/208 KVAC 3 phase, 4 wire
 - b. 100/225 AMP main breakers, or main lugs as indicated, full copper bus, maximum branch circuit 100 amps.
 - c. Pole spaces as indicated on schedules
4. All breakers shall be molded case, quick-make quick-break, thermal magnetic trip, or inverse time (for motor loads), bolted-in type. Multipole breakers shall be of the common trip type. Breakers used as light switches shall be marked "SWD". Provide ground fault breakers where required. Install Eaton, Square D, or Siemens circuit breakers or authorized equal.
5. Provide 2 spare single pole breakers at every panel.

C. Wiring devices:

1. Provide heavy duty, back wired duplex receptacles of 3-pole grounding type with the third pole U-shaped and grounded to the conduit system, and one of the following:
 - a. Bryant, Hubbell, Pass & Seymour No. 5262
 - b. Iso Gnd No. IG 6300
 - c. ("Surg Bloc") Eagle No. IG1110
 - d. GFI No. GF 5254
 - e. Tamper Proof No. SG62
 - f. Water Proof covers, Pass & Seymour No. 3780-SC
 - g. Lock (key) type, Hubbell: 1121-L, 1122-L, 1123-L, 1124-L
 - h. Hubbell (Water Proof Outlet) No. WP26/CWP26H
2. All devices listed are base specification, all colors and finishes shall be determined by architect. Contractor shall verify with architect prior to submittals and purchase of devices. Receptacles shall be of a grounding type, all units to be U.L. authorized.
3. Outlets are to be recessed.
4. Provide tumbler switches of commercial-industrial type, 20 amp, 120/277 V ac, and one of the following:

	<u>SPST</u>	<u>DPST</u>	<u>SPDT</u>	<u>DPDT</u>
a. Bryant:	4901	4902	4903	4904

b.	Hubbell:	1221	1222	1223	1224
c.	General Electric:	5951	5952	5953	5954
d.	Key Switch Type	20AC1L20AC2L	Etc.	Etc.	

5. Switches are to be recessed.
6. Device Plates: Cover plates shall be provided for all outlets and designed for the particular device being used. In all finished areas, plates shall be brushed stainless steel with beveled edges, and stainless steel semi-flush head fastening screws. At locations where more than one switch and/or outlet occur, cover plates shall be ganged or combination type as required. Weatherproof receptacles shall have flush cast box and hinged, gasketed cover, Pass & Seymour No. 3780-SC, or authorized equal.
7. Floor boxes are to be completely flush type, double outlet with hinged flaps & top, Hubbell, # S-3925, double screw tops at tree, plugs and trim will be brass or stainless steel, and outlet box cast iron. Authorized floor box manufacturers are National, Steel City, Hubbell or authorized equal. Brass carpet flanges are to be installed in all carpeted areas.
8. Provide ground fault receptacles or circuit breakers where noted and indicated on drawings.
9. In cases where a single outlet is served by one 20 AMP circuit, provide 20 AMP rated receptacle.

D. Above floor raceways:

1. Provide EMT, steel conduit with set screw fittings, for all conduit concealed in the new masonry walls and run exposed.
 - a. Indenter fittings are not acceptable.
2. Utilize the following for concealed wiring:
 - a. Type "MC" cable and wire were run concealed in walls and ceilings.
 - b. PVC conduit in concrete slabs with steel elbows and appropriate grounding wire.
3. Provide deep boxes with 1" and larger conduit.
4. For lighting outlets, provide standard 4" octagon or square units, with 3/8" malleable iron fixture studs and box hangers where required.
5. For switches and receptacles, provide standard gang switch boxes or architectural surface mounted boxes with non- conductive plastic covers; except for non-Architectural exposed work provide pressed steel boxes with galvanized or cadmium plated steel covers.
6. Provide boxes 4" square by 1-1/2" deep, except for boxes at ends of run where containing a single device. These may be No. 180 handy boxes if permitted by the governing code.
7. For pull boxes, provide galvanized code-gage sheet steel units built from authorized Drawings, with screwed-on covers, of size and shape required to accommodate wires without crowding, and to suit the location.
8. All troughs and gutters are to be as manufactured by Square "D". No troughs, wireways, or gutters shall be fabricated by the Contractor without submitting drawings showing details of construction, method of fastening, gauge of metal, paint specifications, etc., for approval.
9. Provide sleeves, chases and fire stops where conduits pass through floors and walls, and where required.
10. Where shown on Drawings, provide empty conduits for future Owner, telephone company, or others' use.
11. Provide pull wires and junction boxes or LBs in ALL empty conduit runs. Place junction boxes so that 100' of fish line can be used to pull wires if required.

E. Conductors:

1. For line voltages, provide 600 V insulated copper wire and cable, NEC standard, of types specified below for different applications, with UL label, and color-coded as required by governmental agencies having jurisdiction.
2. With conductors No. 4 and larger, provide insulating bushings or insulating sleeves.

3. For all wire and cable provide THWN-2 insulation, 75° C. Identify feeder neutrals with white tape.
4. Where branch circuit wiring is installed in wiring channels of continuous row-mounted fixtures, provide UL type RHH or other authorized 105° C wires, rated at 600 V.
5. Provide stranded wire, in all sizes.
 6. For wire in conduits subjected to direct, sunlight, provide XHHW.
 7. Use only copper wires and cables.
 8. Install plenum wire and cable wherever required by code.
9. For all 20 AMP circuits over 100 feet, use #10 AWG only, over 200 feet use #8 AWG only.

F. Exterior and Water Tight Junction Boxes

1. At all termination and intermediate junction points on exterior conduits, but not greater than 100 feet apart, provide a watertight/raintight Crouse Hinds type WDB box.
2. Install boxes flush with surface and provide appropriate conduit openings.
3. Seal all conduits entering box.

2.4 LIGHTING FIXTURES

- A. Provide all lighting fixtures required in accordance with the schedule as shown on the drawings.

2.5 GENERAL LIGHTING FIXTURE INSTRUCTIONS

- A. Provide all lamps and accessories, such as strips, yokes, mounting plates, frames, nipples or brackets, shall be provided for proper and complete installation.
- B. Recessed fixtures:
1. Provide units having an attached pull box, and with UL label.
 2. Provide local label in addition if so required by governmental agencies having jurisdiction.
 3. Provide fixtures authorized for direct contact with insulation where in direct contact with insulation.
 4. Orient fixtures with elliptical beamspreads with the long axis oriented as recommended by the manufacturer for each specific condition.
 5. All ballasts must have low noise ratings.
 6. Provide all lamps rated at 130 Volts.

2.6 EMERGENCY LIGHTING SYSTEMS

- A. Emergency lighting shall be powered from individual battery inverters, either stand alone or integral with lighting fixtures. Refer to floor plans.

2.7 LIGHTING SWITCHING

- A. Provide individual light switches where indicated on Drawings.
- B. NOTE: for all fixtures with built-in emergency ballasts, these ballasts must be wired to supply ahead of control contactors. In most cases, this will require an additional conductor.
- C. Provide timers and contactors for lighting as required or as shown on the drawings.

2.8 MOTOR STARTERS

- A. Provide magnetic motor starters when required and not supplied by the equipment manufacturers. Coordinate with all other Contracts. HVAC units are to be supplied with integral starters. Exhaust fans are to be provided with magnetic motor starters by the Electrical Contractor. Confirm status for all other equipment.
- B. Units are to be NEMA rated as motor starters and sized to the proper horsepower with thermal overloads on all three legs.
- C. Units are to be in NEMA 1 (Indoor) or NEMA 3 (Outdoor) enclosures with stop/start buttons in the proper locations when required. OL resets to be in cover.
- D. Control circuits to be a maximum of 120 V when push buttons are used. Lower voltage coils may be required in specialized control circuits. Supply transformers as needed.
- E. Provide auxiliary contacts for control circuits as required.

2.9 SAFETY SWITCHES

- A. Provide fusible and non-fusible safety switches of heavy-duty type, horsepower rated, quick-make and quick-break design, externally operated with provision for padlocking.
- B. Provide enclosures clearly marked for maximum voltage, current, and horsepower rating, and use:
 - 1. Indoors: NEMA type 1.
 - 2. Outdoors: NEMA type 3R, raintight.
- C. For switches having dual ratings (higher rating when used with dual-element fuses), provide ratings indicated on a metal plate riveted or otherwise permanently fastened to the enclosure.
- D. Provide at all rooftop units, exhaust fans, unit heaters, hot water heaters, pumps and other HVAC equipment, as required to comply with local codes. Coordinate with HVAC Contractor to confirm equipment type being provided and to assure completeness of final installation.
- E. Provide at supply of transformers only when transformer is not in the same room as the supply circuit breaker.

2.10 POWER WIRING OF EQUIPMENT

- A. Provide feeders, connection and disconnects for all HVAC equipment including air handlers, condensers, and fans.
- B. Air conditioning and low voltage heating equipment (below 110V) controls, panels, motor controls, thermostats, and control devices will be under HVAC work, provide 115V feeds where required, coordinate with HVAC Contractor.
- C. Provide feeders and connection for all Plumbing equipment.
- D. Provide feeders and switches when required, and connection for all equipment provided by others, including motorized doors, partitions, bleachers etc.

2.11 EMPTY CONDUITS

- A. Where indicated on drawings, provide 3/4" conduit and pull wire with J Box above ceiling.

- B. Provide main mounting panel consisting of 3/4" x 8' x 4' fire retardant plywood panels, secured to wall, with a minimum of 4 anchoring bolts of an approved type. Provide at WCO2 telephone area and WCO3 telephone area coordinate installation locations in the field.

2.12 DIGITAL TIME CLOCK

- A. Furnish and install where indicated on the plans a 2 (1) channel digital time switch.
- B. Controller shall program in AM/PM or 24-hour format by jumper selection.
- C. Controller shall program in one-minute resolution.
- D. Controller shall program using 2 buttons only for all its basic settings.
- E. Controller shall be capable of 48 events per channel per week; separate scheduling for each day of the week.
- F. Controller shall have 365-day holiday capabilities with 16 single dates and 5 holiday blocks of unlimited duration utilizing 8th and 9th day schedules.
- G. Controller shall have user selectable Daylight Saving or Standard time.
- H. Controller shall have automatic Leap Year correction.
- I. Controller shall have 72-hour memory backup with rechargeable battery.
- J. Controller shall be capable of manual override ON or OFF to the next scheduled event using 1 button for each channel.
- K. Unit shall have NEMA type III indoor/outdoor enclosure as standard.
- L. DZS 200 series only. Controller shall be capable of having 2 different signal durations 1-99 seconds, user settable and assignable to each channel.
- M. Controller shall be capable of having astronomic on one or both channels with 1-99 minutes, plus or minus offset from Sunrise or Sunset.
- N. TORK Model DG 120 as indicated on schedule or approved equal.

2.13 CONTROL SWITCHES

- A. The remote control switch shall be electrically operated by a dual acting, single-solenoid mechanism that is inherently interlocked and mechanically held in both the open and closed positions. The main contacts shall be power-driven in both directions. Positive locking of contact positions shall not be dependent on gravity, hooks, latches or semi-permanent magnets.
- B. The remote control switch shall be capable of operating in any position. Provisions shall be incorporated for manual operation during inspection and maintenance.
- C. The remote control switch shall be Underwriters' Laboratories listed under UL 508. Main contacts shall be double-break, continuous-duty rated 20 amperes to 600 volts AC, 60 Hz (30 amperes to 600

volts AC, 60 Hz, for general-purpose loads), and be marked for ballast lighting (electric discharge lamps), tungsten and general-purpose loads. Lighting contractors requiring de-rating when used in enclosure or with tungsten lamp loads shall not be acceptable.

- D. The remote control switches shall be provided with clamp-type, self-rising terminal plates for solderless connection of line, load and control conductors. Terminals shall accept a wire range of #18 AWG to #10 AWG CU.
- E. The number of poles, up to a maximum of 12, on a single remote control lighting contactor, shall be provided as indicated on the plans.
- F. The remote control switches shall be UL listed for the following short-circuit withstand current ratings when coordinated with a UL-listed molded case circuit breaker rated so amperes:
 - 22,000 amps rms symmetrical, 250 volts, 60 Hz
 - 14,000 amps rms symmetrical, 480 volts, 60 Hz
 - 10,000 amps rms symmetrical, 600 volts, 60 Hz
- G. The operating coil and main contacts shall be replaceable from the front without major assembly and visual indication shall be provided for each contact.
- H. Provisions shall be included to permit remote pilot lamp-type visual indications without the necessity for auxiliary contacts or additional wiring.
- I. Provide an auxiliary Form C single-pole, double-throw contact as part of the remote control switch to indicate position of the main contacts. The auxiliary contacts shall be rated 10 amperes, 1/3 hp at 277 volts AC; 0.5 amperes, at 125 volts DC and 0.25 amperes at 250 volts DC.
- J. Two-Wire Control Module - A two wire type interface control module shall be supplied wired and mounted directly to the remote control switch. The control voltage and wiring shall be as shown on the drawings. The control module shall be UL listed and be suitable for an operating voltage range of 80 to 125 percent of nominal and operate over an ambient temperature range of 0°C to 45°C.
- K. Each remote control switch shall be furnished with and owner's manual providing installation and operating instructions.
- L. Remote control switch shall be mounted in a NEMA 1 enclosure for indoor applications and NEMA 3R for outdoor applications.
- M. The remote control switch shall be ASCO 917, or approved equal.

2.14 FIRE ALARM AND SMOKE DETECTION SYSTEM

A. Summary

1. Summary - Fire

This performance specification provides the minimum requirements for the Life Safety System. The system shall include, but not limited to all equipment, materials, labor, documentation and services necessary to furnish and install a complete, operational system to include but not limited to the following functions:

Smoke and fire detection.
Off-premise notification.

2. Manufacturer

Acceptable fire alarm system manufacturers include:
Edwards Systems Technology, Inc.
Notifier
Siemens
Or approved equal.

All equipment and components shall be the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

The contractor shall provide, from the acceptable manufacturer's current product lines, equipment and components, which comply, with the requirements of these specifications. Equipment or components, which do not provide the performance and features, required by these specifications are not acceptable, regardless of manufacturer.

3. Alternates - Fire

Strict conformance to this specification is required to ensure that the installed and programmed system will function as designed, and will accommodate the future requirements and operations of the building owner. All specified operational features must be met without exception.

The authorized representative of the manufacturer of the major equipment shall be responsible for the satisfactory installation of the complete system.

All equipment and components shall be the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling system, access control, and smoke control. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

All control panel assemblies and connected field appliances shall be provided by the same system supplier, and shall be designed and tested to ensure that the system operates as specified. The system shall utilize independently addressed, microprocessor-based smoke detectors, heat detectors, as described in this specification.

All equipment and components shall be installed in strict compliance with the manufacturer's recommendations.

The equipment to be supplied will be considered only if it meets all sections of the performance specification. Any deviations of system performance outlined in this specification will only be considered when the following requirements have been met:

A complete description of proposed alternate system performance methods with three (3) copies of working drawings thereof for approval by the Owner, not less than ten (10) calendar days prior to the scheduled date for submission of bids.

The supplier shall furnish evidence that the proposed or alternate system performance is equal or superior to the system operation stated in the specification. Such evidence shall be submitted to and accepted by the Owner, not less than ten (10) calendar days prior to the scheduled date for

submission of bids.

The supplier shall submit a point-by-point statement of compliance for all sections in this specification. The statement of compliance shall consist of a list of all paragraphs within these sections. Where the proposed system complies fully with the paragraph as written, placing the word "comply" opposite the paragraph number shall indicate such. Where the proposed system does not comply with the paragraph as written, and the supplier feels the proposed system will accomplish the intent of the paragraph, a full description of the function as well as a full narrative description of how its proposal will meet its intent shall be provided. Any submission that does not include a point by point statement of compliance as described herein shall be disqualified. Where a full description is not provided, it shall be assumed that the proposed system does not comply.

The acceptability of any alternate proposed system shall be the sole decision of the Owner or his authorized representative.

B. References

1. Codes

a. Codes - Fire

The equipment and installation shall comply with the current provisions of the following codes and standards:

NFPA 70 - National Electric Code®

NFPA 72 - National Fire Alarm Code®

NFPA 90A - Air Conditioning Systems

UL 864 - Control Units for Fire Protective Signaling Systems.

UL 268 - Smoke Detectors for Fire Protective Signaling Systems.

UL 268A - Smoke Detectors for Duct Applications.

UL 217 - Single and Multiple Station Smoke Alarms

UL 521 - Heat Detectors for Fire Protective Signaling Systems.

UL 228 - Door Closers-Holders, With or Without Integral Smoke Detectors.

UL 464 - Audible Signaling Appliances.

UL 38 - Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems

UL 1971 - Signaling Devices for the Hearing-Impaired.

UL 1481 - Power Supplies for Fire Protective Signaling Systems.

UL 1635 - Digital Alarm Communicator System Units

Federal Codes and Regulations

Americans with Disabilities Act (ADA)

International Standards Organization (ISO)

ISO-9000

ISO-9001

C. System Description

1. General

a. General - Fire

The Contractor shall furnish all labor, services and materials necessary to furnish and install a complete, functional fire alarm system (System). The System shall comply in respects with all pertinent codes, rules, regulations and laws of the Authority, and local jurisdiction. The System shall comply in all respects with the requirements of the specifications, manufacturer's recommendations and Underwriters Laboratories Inc. (ULI) listings.

It is further intended that upon completion of this work, the Owner be provided with:

Complete information and drawings describing and depicting the entire system(s) as installed, including all information necessary for maintaining, troubleshooting, and/or expanding the system(s) at a future date.

Complete documentation of system(s) testing.

Certification that the entire system(s) has/have been inspected and tested, is/are installed entirely in accordance with the applicable codes, standards, manufacturer's recommendations and ULI listings, and is/are in proper working order. Contractor shall use "Fire Alarm System Certification and Description" as required by Section 1-6.2 of NFPA 72 - 1999 edition.

b. Description

1. Description - Fire

- a. Provide and install a new fire detection and alarm system consisting of:

LCD annunciator shall be located as shown on the drawings.

Manual pull stations shall be located as shown on the drawings.

Area smoke detection shall be provided as shown on drawings.

Area heat detection shall be provided as shown on drawings.

Duct smoke detection shall be provided as shown on the drawings.

Provide audible appliances located throughout the building, as shown on the drawings.

Provide synchronized visual appliances located throughout the building.

Provide fan shutdown controls as shown on drawings.

Provide connection to a Central Station. The contractor shall arrange for two dedicated phone lines to be terminated.

c. Operations

1. Sequence of Operations

- a. General

Upon the alarm activation of any area smoke detector, heat detector, manual pull station, the following functions shall automatically occur:

The internal audible device shall sound at the control panel or command center.

Display the alarm event on the graphical workstation.

The LCD display shall indicate all applicable information associated with the alarm condition including; zone, device type, device location and time/date.

All system activity/events shall be documented on the system printer.

Any remote or local annunciator LCD/LED's associated with the alarm zone shall be illuminated.

Activate visual strobes notification appliances on the fire general alarm evacuation. The visual strobe shall continue to flash until the system has been reset. The visual strobe shall not stop operating when the "Alarm Silence" is pressed.

Transmit signal to the central station with point identification.

Activate automatic smoke control sequences.

All automatic events programmed to the alarm point shall be executed and the associated outputs activated.

b. Duct Smoke Activation - Alarm

The alarm activation of any duct smoke detector, the following functions shall automatically occur:

The internal audible device shall sound at the control panel or command center.

Display the event on the graphical workstation and display a pictorial image.

The LCD display shall indicate all applicable information associated with the alarm condition including; zone, device type, device location and time/date.

All system activity/events shall be documented on the system printer.

Any remote or local annunciator LED's associated with the alarm zone shall be illuminated.

Transmit signal to the central station with point identification.

Shutdown the local air handling unit.

All automatic events programmed to the alarm point shall be executed and the associated outputs activated.

- c. **Trouble Operation**
Upon activation of a trouble condition or signal from any device on the system, the following functions shall automatically occur:

The internal audible device shall sound at the control panel or command center.

Display the event on the graphical workstation and display a pictorial image.

The LCD keypad display shall indicate all applicable information associated with the trouble condition including; zone, device type, device location and time/date.

All system activity/events shall be documented on the system printer.

Any remote or local annunciator LCD/LED's associated with the trouble zone shall be illuminated.

Transmit signal to the central station with point identification.

- d. **Monitor Activation**
Upon activation of any device connected to a monitor circuit, the following functions shall automatically occur:

The internal audible device shall sound at the control panel or command center

The LCD display shall indicate all applicable information associated with the status condition including; zone, device type, device location and time/date.

All system activity/events shall be documented on the system printer.

Any remote or local annunciator LCD/LED's associated with the status zone shall be illuminated.

- d. **System Configuration**
 - 1. **General**

All Life Safety System equipment shall be arranged and programmed to provide the early detection of fire, the notification of building occupants, the automatic summoning of the local fire department, the override of the HVAC system operation, and the activation of other auxiliary systems to inhibit the spread of smoke and fire, and to facilitate the safe evacuation of building occupants.

2. **Power Supply**
Standby power supply shall be an electrical battery with capacity to operate the system under maximum supervisory load for 24 hours and capable of operating the system for 5 minutes in the alarm mode at 100% load. The system shall include a charging circuit to automatically maintain the electrical charge of the battery. The system shall automatically adjust the charging of the battery to compensate for temperature.
3. **Display**
The main display interface shall show the first and most recent highest priority system events without any operator intervention. All system events shall be directed to one of four message queues. Messages of different types shall never intermixed to eliminate operator confusion. A "Details" switch shall provide additional information about any device highlighted by the operator.
4. **Initiating Device Circuits**
Initiating device circuits monitoring manual fire alarm stations, smoke and heat detectors, shall be Class A (Style "D" or "E).
5. **Notification Appliance Circuits**
All notification appliance circuits shall be Class A (Style "Z. All notification appliance circuits shall have a minimum circuit output rating of: 2 amps @ 24 vdc; 50 watts @ 25V audio, and 35 watts @ 70V audio. The notification circuits shall be power limited. Non-power limited circuits are not acceptable.
6. **Signaling Line Circuits**
When a signaling line circuit covers more than one fire/smoke compartment, a wire-to-wire short shall not effect the operation of the circuit from the other fire/smoke compartments.

The signaling line circuit connecting to addressable/analog devices including, detectors, monitor modules, control modules, isolation modules, intrusion detection modules and notification circuit modules shall be Class A (style 6 or 7).
7. **DACT**
The system shall provide off premise communications capability (DACT) for transmitting system events to multiple Central Monitoring Station (CMS) receivers. The system shall provide the CMS(s) with point identification of system events using Contact ID or SIA DCS protocols. The system shall provide an individual CMS account for each tenant, and send the required signals to the

one or more CMS(s) and account(s) specified by each tenant. In the event of a panel CPU failure during a fire alarm condition, the DACT degrade mode shall transmit a general fire alarm signal to the CMS.

The system shall also transmit an alphanumeric system activity message, by event, to a commercial paging system of the owners choice, using TAP Pager protocol.

D. Submittals

1. Project

The contractor shall purchase no equipment for the system specified herein until the owner has approved the project submittals in their entirety and has returned them to the contractor. It is the responsibility of the contractor to meet the entire intent and functional performance detailed in these specifications. Approved submittals shall only allow the contractor to proceed with the installation and shall not be construed to mean that the contractor has satisfied the requirements of these specifications. The contractor shall submit three (3) complete sets of documentation within 30 calendar days after award of purchase order.

Each submittal shall include a cover letter providing a list of each variation that the submittal may have from the requirements of the contract documents. In addition the Contractor shall provide specific notation on each shop drawing, sample, catalog cut, data sheet, installation manual, etc. submitted for review and approval, of each such variation.

All drawings and diagrams shall include the contractor's title block, complete with drawing title, contractor's name, address, date including revisions, and preparer's and reviewer's initials

2. Product Data

Data sheets with the printed logo or trademark of the manufacturer for all equipment. Indicated in the documentation will be the type, size, rating, style, and catalog number for all items proposed to meet the system performance detailed in this specification. The proposed equipment shall be subject to the approval of the Architect/Engineer.

3. Shop Drawings

A complete set of shop drawings shall be supplied. The shop drawings shall be reproduced electronically in digital format. This package shall include but not be limited to:

Control panel wiring and interconnection schematics.

Complete point to point wiring diagrams.

Riser diagrams.

Complete floor plan drawing locating all system devices and 1/4" = 1'-0" scale plan and elevation of all equipment in the Fire Command Station. Including showing the placement of each individual item of fire alarm, security, and access control equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.

Detailed system operational description. Any Specification differences and deviations shall be clearly noted and marked.

Complete system bill of material.

All drawings shall be reviewed and signed off by an individual having a minimum of a NICET certification in fire protection engineering technology, subfield of fire alarm systems.

4. Samples

A sample of each smoke detector, intelligent modules, horn, strobes, card reader controller, card reader, and door locking mechanism shall be provided to the contractor for their familiarization.

5. Quality Assurance/Control Submittals
Installer's Certification

The engineered systems distributor must be licensed in the state of project location and have been incorporated in the business in that state for a minimum of 5 years.

Submit a copy of the system supplier's training certification issued by the manufacturer of the integrated life safety system, and a copy of the installing technician's NICET certification.

6. System Calculations

Complete calculations shall be provided which show the electrical load on the following system components:

Each system power supply, including stand alone booster supplies.

Each standby power supply (batteries).

Each notification appliance circuit.

Each auxiliary control circuit that draws power from any system power supply.

7. Close Out

Three (3) copies of the following documents shall be delivered to the building A&E at the time of system acceptance. The close out submittals shall include:

Project specific operating manuals covering the installed integrated life safety system. The manual shall contain a detailed narrative description of the system architecture, inputs, notification signaling, auxiliary functions, annunciation, sequence of operations, expansion capability, application considerations and limitations. Manufacturer's data sheets and installation manuals/instructions for all equipment supplied. A generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.

As-Built drawings consisting of: a scaled plan of each building showing the

placement of each individual item of the Integrated Life Safety System equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.

All drawings shall be provided in standard .DXF format. A vellum plot of each sheet shall also be provided.

The application program listing for the system as installed at the time of acceptance by the building owner and/or local AHJ (disk, hard copy printout, and all required passwords).

Provide the name, address and telephone of the authorized factory representative.

A filled out Record of Completion similar to NFPA 72, edition figure 1-6.2.1.

E. Quality Assurance

1. Qualifications of Contractor

a. Fire

The contractor shall have successfully installed similar system fire detection, evacuation voice and visual signaling control components on a previous project of comparable size and complexity. The owner reserves the right to reject any control components for which evidence of a successful prior installation performed by the contractor cannot be provided.

The contractor shall have in-house engineering and project management capability consistent with the requirements of this project. Qualified and approved representatives of the system manufacturer shall perform the detailed engineering design of central and remote control equipment.

Qualified and approved representatives of the system manufacturer shall produce all panel and equipment drawings and submittals, operating manuals. The contractor is responsible for retaining qualified and approved representative(s) of those system manufacturers specified for detailed system design and documentation, coordination of system installation requirements, and final system testing and commissioning in accordance with these specifications.

F. Delivery, Storage and Handling

1. Receiving and Handling

The Contractor shall be responsible for all receiving, handling, and storage of his materials at the job site.

2. Storage

All on site storage shall be the sole responsibility of the contractor.

3. Rubbish

The Contractor shall remove rubbish and debris resulting from his work on a daily basis.

G. Project Conditions

1. Project Conditions

It shall be the Contractor's responsibility to inspect the job site and become familiar with the conditions under which the work will be performed.

A pre-bid meeting will be held to familiarize the Contractors with the project. Failure to attend the pre-bid meeting may be considered cause for rejection of the Contractor's bid. The minutes of this meeting will be distributed to all attendees and shall constitute an addendum to these specifications.

All work, may be conducted during normal working hours.

H. Warranty and Maintenance

1. Spare Parts

a. Spare Parts - Fire

The Contractor shall supply the following spare parts:

Automatic detection devices - Two (2) percent of the installed quantity of each type.

Manual fire alarm stations - Two (2) percent of the installed quantity of each type.

Audible and visible devices - One (1) percent of the installed quantity of each type, but no less than two (2) devices.

Keys - A minimum of three (3) sets of keys shall be provided and appropriately identified.

2. Warranty

The contractor shall warranty all materials, installation and workmanship for one (1) year from date of acceptance, unless otherwise specified. A copy of the manufacturer's warranty shall be provided with close-out documentation and included with the operation and installation manuals.

The System Supplier shall maintain a service organization with adequate spare parts stock within 75 miles of the installation. Any defects that render the system inoperative shall be repaired within 24 hours of the owner notifying the contractor.

3. Training

The System Supplier shall schedule and present a minimum of 8 hours of documented formalized instruction for the building owner, detailing the proper operation of the installed System.

The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.

The instruction shall cover the schedule of maintenance required by NFPA 72 and any additional maintenance recommended by the system manufacturer.

Instruction shall be made available to the Local Municipal Fire Department if requested by the Local Authority Having Jurisdiction.

I. Products

1. Manufacturer

a. Fire

The manufacturer of the system equipment shall be regularly involved in the design, manufacture, and distribution of all products specified in this document. These processes shall be monitored under a quality assurance program that meets the ISO 9000 requirements.

All System components shall be the cataloged products of a single supplier. All products shall be listed by the manufacturer for their intended purpose.

Edwards Systems Technology, Inc. products constitute the minimum type and quality of equipment to be installed.

All control panel assemblies and connected field appliances shall be both designed and manufactured by the same company, and shall be tested and cross-listed as to ensure that a fully functioning is designed and installed. The system supplied under this specification shall be a microprocessor-based direct wired, multi-priority peer-to-peer networked system. The system shall utilize independently addressed, microprocessor-based smoke detectors, heat detectors, and modules as described in this specification.

2. Panel Components & Functions

a. General Fire

The control panel(s) shall be a multi-processor based networked system designed specifically for fire, one-way and two-way emergency audio communications, smoke control, and guard patrol applications. The control panel shall be listed and approved for the application standard(s) as listed under the General section.

The control panel shall include all required hardware, software and site specific system programming to provide a complete and operational system. The control panel(s) shall be designed such that interactions between any application can be configured, and modified using software provided by a single supplier. The control panel(s) operational priority shall assure that life safety takes precedence among the activities coordinated by the control panel.

The control panel shall include the following capacities:

Support up to 2500 analog/addressable points.

Support network connections up to 63 other control panels and annunciators.

Support multiple digital dialers and modems

Support multiple communication ports and protocols

Support up to 1740 chronological events.

The network of control panels shall include the following features:

Ability to download all network applications and firmware from the configuration computer from the configuration computer from a single location on the system.

Provide electronic addressing of analog/addressable devices.

Provide an operator interface control/display that shall annunciate, command and control system functions.

Provide an internal audible signal with different programmable patterns to distinguish between alarm, supervisory, trouble and monitor conditions. Provide a discreet system control switch provided for reset, alarm silence, panel silence, drill switch, previous message switch, next message switch and details switch.

Provide system reports that provide detailed description of the status of system parameters for corrective action or for preventative maintenance programs. Reports shall be displayed by the operator interface or capable of being printed on a printer.

Provide an authorized operator with the ability to operate or modify system functions like system time, date, passwords, holiday dates, restart the system and clear control panel event history file.

Provide an authorized operator to perform test functions within the installed system.

The control panel shall contain a standby power supply that automatically supplies electrical energy to the system upon primary power supply failure. The system shall include a charging circuit to automatically maintain the electrical charge of the battery.

3. Operator's Interface Annunciation

The system shall be designed and equipped to receive, monitor, and annunciate signals from devices and circuits installed throughout the building. Standard LED annunciators may be combined in common enclosures provided that the groups of LEDs comprising each of the required annunciators are separated from one another (Detection, Supervisory, Status, and Status) and clearly labeled.

Manufacturers' standard control switches shall be acceptable if they provide the required operation, including performance, supervision and position indication. If the manufacturers' standard switches do not comply with these requirements, fabrication of custom manual controls acceptable to the Owner is required.

Receipt of alarm, trouble, and supervisory signals shall activate integral audible devices at the control panel(s) and at each remote annunciation device. The integral audible devices shall produce a sound output upon activation of not less than 85 dBA at 10 feet. The annunciator shall contain the following system status indicators:

168 character backlit Liquid Crystal Display

System Normal Indicator

System Common Alarm Indicator

System Common Trouble Indicator

System Common Supervisory Indicator

System Ground Fault Indicator

System Common Security Indicator

System Disabled Point(s) Indicator

System Reset Switch with Indicator

System Alarm Silence Switch with Indicator

System Trouble Silence Switch with Indicator

System Message Queue Scroll Switches.

10-Digit Keypad to Enable/Disable System and Functions.

The LED annunciator rows shall contain the following format:

Provide one row of red (alarm) and yellow (trouble) LED's. LED's in each row shall be arranged in columns, one column per type of alarm initiating device, and shall illuminate upon receipt of an alarm signal from the associated device(s) (i.e., electrical room smoke detector).

Provide one row of red (alarm) LED's. LED's in each row shall be arranged in columns, one column per type of alarm initiating device, and shall illuminate upon receipt of an alarm signal from the associated device(s) (i.e., electrical room smoke detector).

Provide one row of yellow (supervisory) LED's. LED's in each row shall be arranged in columns, one column per type of supervisory type device, and shall illuminate upon receipt of an supervisory signal from the associated device(s).

The LED annunciator shall be provided with <25>% spare LED's minimum. Each pair of LED's shall be labeled "Spare".

4. DACT Dialer

The system shall provide off premise communications capability using a digital alarm communications transmitter (DACT) for sending system events to multiple central monitoring station (CMS) receivers. The system shall provide the CMS(s) with point identification of system events using Contact ID or SIA DCS protocols. The system shall provide an individual CMS account for each tenant, and send the required signals to the one or more CMS(s) and account(s) specified by each tenant. In the event of a panel CPU failure during a fire alarm condition, the DACT degrade mode shall transmit a general fire alarm signal to the CMS.

5. Power Supply

System power supply(s) shall provide multiple power limited 24 VDC output circuits as required by the panel.

Upon failure of normal (AC) power, the affected portion(s) of the system shall automatically switch over to secondary power without losing any system functions.

Each system power supply shall be individually supervised. Power supply trouble signals shall identify the specific supply and the nature of the trouble condition.

All standby batteries shall be continuously monitored by the power supply. Low battery and disconnection of battery power supply conditions shall immediately be annunciated as battery trouble and identify the specific power supply affected.

All system power supplies shall be capable of recharging their associated batteries, from a fully discharged condition to a capacity sufficient to allow the system to perform consistent with the requirements of this section, in 48 hours maximum.

All AC power connections shall be to the building's designated emergency electrical power circuit and shall meet the requirements of NFPA 72 - The AC power circuit shall be installed in conduit raceway. The power circuit disconnect means shall be clearly labeled FIRE ALARM CIRCUIT CONTROL and shall have a red marking. The location of the circuit disconnect shall be labeled permanently inside the each control panel the disconnect serves.

6. Reports

The system shall provide the operator with system reports that give detailed

description of the status of system parameters for corrective action, or for preventative maintenance programs. The system shall provide these reports via the main LCD, and shall be capable of being printed on any system printer.

The system shall provide a report that gives a sensitivity listing of all detectors that have less than 75% environmental compensation remaining. The system shall provide a report that provides a sensitivity (% Obscuration per foot) listing of any particular detector.

The system shall provide a report that gives a listing of the sensitivity of all of the detectors on any given panel in the system, or any given analog/addressable device loop within any given panel.

The system shall provide a report that gives a chronological listing of up to the last 1740 system events.

The system shall provide a listing of all of the firmware revision listings for all of the installed network components in the system.

7. System Printer

The event and status printer shall be a 9-pin, impact, dot matrix printer with a minimum print speed of 232 characters per second. The printer shall be capable of serial or parallel communications protocol. The communications speed for RS-232 communications protocol shall be adjustable from 300 to 9600 Baud. The printer shall list the time, date, type and user defined message for each event printed.

8. Field Mounted System Components

a. Fire Initiating Devices

1. Smoke Detectors & Accessories Analog Addressable Smoke -- General
Each analog addressable smoke detector's sensitivity shall be capable of being programmed individually as: most sensitive, more sensitive, normal, less sensitive or least sensitive. In addition to the five sensitivity levels the detector shall provide a prealarm sensitivity setting, which shall be settable in 5% increments of the detector's alarm sensitivity value.

An alternate alarm sensitivity level shall be provided for each detector, which can be set to any of the five (5) sensitivity settings manually or automatically using a time of day event. In addition to the five alternate sensitivity levels the detector shall provide an alternate prealarm sensitivity setting, which shall be settable in 5% increments of the detector's alternate alarm sensitivity value.

The detector shall be able to differentiate between a long drift above the prealarm threshold and fast rise above the threshold.

The detector's sensing element reference point shall automatically adjust, compensating for background environmental conditions such as dust, temperature, and pressure. Periodically, the sensing element real-time analog value shall be compared against its reference value. The detector shall provide a maintenance alert signal that 75% to 99% compensation has been used. The detector shall provide a dirty fault signal that 100% or greater compensation has been used.

The system shall allow for changing of detector types for service replacement purposes without the need to reprogram the system. The replacement detector type shall automatically continue to operate with the same programmed sensitivity levels and functions as the detector it replaced. System shall display an off-normal condition until the proper detector type has been installed or change in the application program profile has been made.

2. **Duct Detector Housing**
Provide smoke detector duct housing assemblies to mount an analog/addressable detector along with a standard, relay or isolator detector mounting base. The housing shall also protect the measuring chamber from damage and insects. The housing shall utilize an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet. Drilling templates and gaskets to facilitate locating and mounting the housing shall also be provided. The housing shall be finished in baked red enamel. Remote alarm LED indicators and remote test stations shall be provided recessed in ceiling or wall nearest duct mount detector. Each station shall be labelled.
3. **Smoke Detector - Photoelectric**
Provide analog/addressable photoelectric smoke detectors at the locations shown on the drawings. The detector shall have the ability to set the sensitivity and alarm verification of each of the individual detectors on the circuit. It shall be possible to automatically change the sensitivity of individual analog/addressable detectors for the day and night periods. Each smoke detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings. Each detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient environmental thresholds approximately six times an hour. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 75% and 100% of the allowable environmental compensation value.
4. **Smoke Detector Guards**
Smoke detector guards shall be installed at the locations shown on the drawings. The guards shall be Underwriters Laboratories tested and listed by for use with the smoke detectors they protect. Guard design shall not affect the detector operating sensitivity and shall not reduce the listed detector spacing. The guards shall be constructed of 16-gauge steel with a baked white finish to match the detectors. Tamperproof mounting hardware shall be provided.
5. **Detector Bases - Detector Base - Standard**
Provide standard detector mounting bases suitable for mounting on either North American 1-gang, 3½ or 4 inch octagon box and 4 inch square box, or European BESA or 1-gang box. The base shall, contain no electronics and support all series detector types.

6. Manual Stations - Manual Station - Double Action Single Stage
Provide analog/addressable double action, single stage fire alarm stations at the locations shown on the drawings. The fire alarm station shall be of polycarbonate construction and incorporate an internal toggle switch. A locked test feature shall be provided. The station shall be finished in red with silver "PULL IN CASE OF FIRE" lettering. The manual station shall be suitable for mounting on North American 2 ½ (64mm) deep 1-gang boxes and 1 ½ (38mm) deep 4 square boxes with 1-gang covers.

9. Notification Appliances

- a. Horns
 1. Low Profile Horns - Provide low profile wall mount horns at the locations shown on the drawings. The horn shall provide an 84 dBA sound output at 10 ft. when measured in reverberation room per UL-464. The horn shall have a selectable steady or synchronized temporal output. In and out screw terminals shall be provided for wiring. The horn shall mount in a North American 1-gang box.
- b. Horn-Strobes
 1. Low Profile Horn-Strobes - Provide low profile wall mount horn/strobes at the locations shown on the drawings. The horn/strobe shall provide an audible output of 84 dBA at 10 ft. when measured in reverberation room per UL-464. Strobes shall provide synchronized flash outputs. The strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 60cd, 75cd & 110cd devices. The horn shall have a selectable steady or synchronized temporal output. In and out screw terminals shall be provided for wiring. Low profile horn/strobes shall mount in a North American 1-gang box.
- c. Initiation & Control Modules - Relay Module - Provide addressable control relay circuit modules at the locations shown on the drawings. The module shall provide one (1) form C dry relay contacts rated at 24Vdc @ 2 amps (pilot duty) to control external appliances or equipment. The position of the relay contact shall be confirmed by the system firmware.
- d. Notification Appliance Circuits - Provide addressable notification appliance circuit modules at the locations shown on the drawings. The module shall provide one (1) supervised Class B notification circuit. The module shall provide polarized audible / visual selection for 24Vdc @ 2amps, audio outputs at 25Vrms @ 50 watts or 70 Vrms @ 35 watts.
- e. Isolation Module - Provide addressable fault isolator circuit modules at the locations shown on the drawings. The module shall be capable of isolating and removing a fault from a Class A data circuit while allowing the remaining data loop to continue operating.

- J. Execution

1. Installation
 - a. Installation Sequence - Installation of the systems shall be conducted in stages and phased such that circuits and equipment are installed in the following order:
 - Riser conduits, AC power conduits and control cabinets.

- Conduits and wiring for complete notification circuits and appliance installation throughout facility.
 - Pre-test the audible and visual notification appliance circuits.
 - Install all new detection devices.
 - Terminations between field devices and the associated control equipment.
 - The detection system shall be switched over and end of each day the system shall be operational. At no time will the system be placed out of service over night.
 - Complete the interface to the building automation system.
 - Complete contractor pre-test of system.
 - Complete system testing.
2. General - All equipment shall be attached to walls and ceiling/floor assemblies and shall be mounted firmly in place. Detectors shall not be supported solely by suspended ceilings. Fasteners and supports shall be sized to support the required load.
3. Conductors - The requirement of this section apply to all system conductors, including all signaling line, initiating device, notification appliance, auxiliary function, remote signaling, AC and DC power and grounding/shield drain circuits, and any other wiring installed by the Contractor pursuant to the requirements of these Specifications.

All circuits shall be rated power limited in accordance with NEC Article 760.

Installed in conduit or enclosed raceway where required.

All new system conductors shall be of the type(s) specified herein.

All initiating circuit, signaling line circuit, AC power conductors, shield drain conductors and grounding conductors, shall be solid copper, stranded or bunch tinned (bonded) stranded copper.

All signaling line circuits, including all addressable initiating device circuits shall be 18 AWG minimum multi-conductor jacketed twisted cable or twisted shielded or as per manufacturer's requirements.

All non-addressable initiating device circuits, 24 VDC auxiliary function circuits shall be 18 AWG minimum or per manufacturer's requirements.

All notification appliance circuit conductors shall be solid copper or bunch tinned (bonded) stranded copper. Where stranded conductors are utilized, a maximum of 7 strands shall be permitted for No. 16 and No. 18 conductors, and a maximum of 19 strands shall be permitted for No. 14 and larger conductors.

All audible notification appliance circuits shall be 14 AWG minimum twisted pairs or twisted pairs shielded or per manufacturer's requirements.

All visual notification appliance circuits shall be 14 AWG minimum THHN or twisted pairs or twisted shielded pairs or per manufacturer's requirements.

4. Open Cable - Power-limited cable in accordance with NEC 70, where used, not installed in UL listed metal conduit or raceway shall be mechanically protected by building construction features:

Installation shall be in areas not subjected to mechanical injury.

All circuits shall be supported by the building structure. Cable shall be attached by straps to the building structure at intervals not greater than 10 feet. Wiring installed above drop ceilings, cable shall not be laid on ceiling tiles. Cable shall not be fastened in a manner that puts tension on the cable.

Cable type shall be FPLP, FPLR or FPL, or permitted substitutions, selected for the installation application as required by NEC 70, Section 760-61.

All cable that is not enclosed by conduit shall be supported and anchored with nylon straps or clamps. The use of staples is prohibited.

5. Conduit Raceway - All systems and system components listed to UL864 Control Units for Fire Protective Signaling Systems may be installed within a common conduit raceway system, in accordance with the manufacture's recommendations. System(s) or system components not listed to the UL864 standard shall utilize a separate conduit raceway system for each of the sub-systems.

The requirements of this section apply to all system conduits, raceways, electrical enclosures, junction boxes, pull boxes and device back boxes.

All system conduits shall be of the sizes and types specified.

All system conduits shall be EMT, 3/4 -inch minimum, except for flexible metallic conduit used for whips to devices only, maximum length 6 feet, 3/4-inch diameter, minimum.

All system conduits, which are installed in areas, which may be subject to physical damage or weather, shall be IMC or rigid steel, 3/4 -inch minimum.

Conduits shall be sized according to the conductors contained therein. Cross sectional area percentage fill for system conduits shall not exceed 40%.

Provide all new conduit raceway and conduit riser.

All fire alarm conduit systems shall be routed and installed to minimize the potential for physical, mechanical or by fire damage, and so as not to interfere with existing building systems, facilities or equipment, and to facilitate service and minimize maintenance.

All conduits, except flexible conduit whips to devices, shall be solidly attached to building structural members, ceiling slabs or permanent walls. Conduits shall not be attached to existing conduit, duct work, cable trays, other ceiling equipment, drop ceiling hangers/grids or partition walls, except where necessary to connect to initiating, notification, or auxiliary function devices.

All system conduits, junction boxes, pull boxes, terminal cabinets, electrical

enclosures and device back boxes shall be readily accessible for inspection, testing, service and maintenance.

6. Field Quality Control - Test & Inspection - All intelligent analog addressable devices shall be tested for current address, sensitivity, and user defined message.

All wiring shall be tested for continuity, shorts, and grounds before the system is activated.

All test equipment, instruments, tools and labor required to conduct the tests shall be made available by the installing contractor.

The system including all its sequence of operations shall be demonstrated to the Owner, his representative, and the local fire inspector. In the event the system does not operate properly, the test shall be terminated. Corrections shall be made and the testing procedure shall be repeated until it is acceptable to the Owner, his representatives and the fire inspector.

At the final test and inspection, a factory trained representative of the system manufacturer shall demonstrate that the system functions properly in accordance with these specifications. The representative shall provide technical supervision, and participate during all of the testing for the system.

All fire alarm testing shall be in accordance with National Fire Alarm Code, NFPA 72 - 1999, Chapter 7.

A letter from the Contractor certifying that the system is installed entirely in accordance with the system manufacturer's recommendations and within the limitations of the required listings and approvals, that all system hardware and software has been visually inspected and functionally tested by a manufacturer's certified representative, and that the system is in proper working order.

2.15 STANDBY POWER SYSTEMS GENERATOR SET

- 1) Submittal
 - i) The submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number, each required interconnection between the generator set, the transfer switch, and the remote annunciator panel.
- 2) Codes And Standards
 - i) The generator set shall conform to the requirements of the following codes and standards:
 - CSA C22.2, No. 14 – M91 Industrial Control Equipment.
 - ii) EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.
 - iii) EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
 - iv) IEC8528 part 4. Control Systems for Generator Sets

- v) IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.
 - vi) IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
 - vii) Mil Std 461D –1993. Military Standard, Electromagnetic Interference Characteristics.
 - viii) Mil Std 462D - 1993. Military Standard, Measurement of Electromagnetic Interference Characteristics.
 - ix) NFPA70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
 - x) NFPA110 – Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.
- 3) Testing
- i) To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.
 - ii) Design Prototype Tests: Components of the emergency system such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and preproduction models, which will not be sold, shall have been used for the following tests.
 - (1) Maximum power (kW).
 - (2) Maximum motor starting (kVA) at 35% instantaneous voltage dip.
 - (3) Alternator temperature rise by embedded thermocouple and/or by resistance method per NEMA MG1-22.40 and 16.40.
 - (4) Governor speed regulation under steady-state and transient conditions.
 - (5) Voltage regulation and generator transient response.
 - (6) Fuel consumption at 1/4, 1/2, 3/4, and full load.
 - (7) Harmonic analysis, voltage waveform deviation, and telephone influence factor.
 - (8) Three-phase short circuit tests.
 - (9) Alternator cooling air flow.
 - (10) Torsional analysis to verify that the generator set is free of harmful torsional stresses.
 - (11) Endurance testing.
 - (12) Production Tests

Final Production Tests: Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:

- i) Single-step load pickup.
- ii) Transient and steady—state governing.
- iii) Safety shutdown device testing.
- iv) Voltage regulation.
- v) Rated Power @ 0.8 PF
- vi) Maximum Power.
- vii) Upon request, arrangements to either witness this test will be made, or a certified test record will be sent prior to shipment.

b) Site Tests

- i) Site Tests: An installation check, start-up, and building load test shall be performed by the manufacturer's local representative. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:
- ii) Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.
- iii) Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery charger, generator strip heaters, remote annunciator, etc.
- iv) Start-up under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage and frequency, and phase rotation.
- v) Automatic start-up by means of simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator voltage, amperes, and frequency shall be monitored throughout the test. An external load bank shall be connected to the system if sufficient building load is unavailable to load the generator to the nameplate kW rating.

4) Warranty & Maintenance

- a) A one year warranty for the generator set shall be included to guarantee against defective material and workmanship in accordance with the manufacturer's published warranty from date of start-up. Optional warranties shall be available upon request.
- b) The generator set manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall be regularly engaged in a maintenance contract program to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions, adjustment to the generator, transfer switch, and switchgear controls as required, and certification in the owner's maintenance log of repairs made and proper functioning of all systems.

5) Equipment

- a) The generator set shall provide 200 kW, 250 kVA when operating at 120/208 volts, .8 power factor. The generator set shall be capable of this rating while operating in an ambient condition of 104°F (86.2°C) and 3300 feet above sea level.
 - b) The generator set shall be capable of starting motor loads of 400 kVA inrush, with a maximum voltage dip of 35%.
 - c) Vibration isolators shall be provided between the engine-generator and heavy-duty steel base
- 6) Engine
- a) The engine shall be equipped with the following:
 - i) An electronic isochronous governor capable of +0.25% steady-state frequency regulation.
 - ii) 24 Volt positive engagement solenoid shift-starting motor.
 - iii) 40-Ampere minimum automatic battery charging alternator with solid-state voltage regulation.
 - iv) Positive displacement, full pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.
 - v) Dry-type replaceable air cleaner elements for heavy-duty applications.
 - b) The engine shall be natural gas fueled, radiator and fan cooled. Minimum displacement shall be 864 cubic inches. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories.
 - c) Complete engine fuel system, fuel lines, strainers, and control valves. The fuel system shall be integral to the unit.
 - d) The engine shall have a minimum of 6 cylinders, and be liquid-cooled by a unit-mounted radiator, blower fan, water pump, and thermostats. This system shall properly cool the engine with up to 0.5 inches H₂O static pressure on the fan in an ambient temperature up to 122F/50C.
 - e) The engine shall be EPA certified
- 7) Generator
- a) The alternator shall be salient-pole, brushless, 12-lead reconnectable, self-ventilated of drip-proof construction with amortisseur rotor windings and skewed stator for smooth voltage waveform. The insulation shall meet the NEMA standard (MG1-22.40 and 16.40) for Class H and be insulated with epoxy varnish to be fungus resistant per MIL 1-24092. Temperature rise of the rotor and stator shall be limited to 150°C. The excitation system shall be of brushless construction controlled by a solid-state voltage regulator capable of maintaining voltage within +/- 2% at any constant load from 0% to 100% of rating. The regulator must be isolated to prevent tracking when connected to SCR loads, and provide individual adjustments for voltage range, stability and volts-per-hertz operations; and be protected from the environment by conformal coating.
 - b) The generator set shall meet the transient performance requirements of ISO 8528-5, level G-2.

- c) The alternator excitation shall be of a permanent magnet exciter design.
- d) The generator shall be inherently capable of sustaining at least 250% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current support devices.
- e) The generator, having a single maintenance-free bearing, shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.

Controller

- f) Set-mounted controller capable of facing right, left, or rear, shall be vibration isolated on the generator enclosure. The controller shall be capable of being remote-mounted. The microprocessor control board shall be moisture proof and capable of operation from -40°C to 85°C. Relays will only be acceptable in high-current circuits.
- g) Circuitry shall be of plug-in design for quick replacement. Controller shall be equipped to accept a plug-in device capable of allowing maintenance personnel to test controller performance without operating the engine. The controller shall include the following features:
 - i) Fused DC circuit.
 - ii) Complete 2-wire start/stop control, which shall operate on closure of a remote contact.
 - iii) Speed sensing and a second independent starter motor disengagement systems shall protect against starter engagement with a moving flywheel. Battery charging alternator voltage will not be acceptable for this purpose.
 - iv) The starting system shall be designed for restarting in the event of a false engine start, by permitting the engine to completely stop and then re-engage the starter.
 - v) Cranking cyler with 15-second ON and OFF cranking periods.
 - vi) Overcrank protection designed to open the cranking circuit after 75 seconds if the engine fails to start.
 - vii) Circuitry to shut down the engine when signal for high coolant temperature, low oil pressure, or overspeed are received.
 - viii) Engine cooldown timer factory set at 5 minutes to permit unloaded running of the standby set after transfer of the load to normal.
 - ix) 3-position (Automatic-OFF-TEST) selector switch. In the TEST position, the engine shall start and run regardless of the position of the remote starting contacts. In the Automatic position, the engine shall start when contacts in the remote control circuit close and stop 5 minutes after those contacts open. In the OFF position, the engine shall not start even though the remote start contacts close. This position shall also provide for immediate shutdown in case of an emergency. Reset of any fault shall also be accomplished by putting the switch to the OFF position.
 - x) Alarm horn with silencer switch per NFPA 110.

h) Standard indicating lights to signal the following shall be included:

- i) Not-in-Auto (flashing red)
- ii) Overcrank (red)
- iii) Emergency Stop (red)
- iv) High Engine Temperature (red)
- v) Overspeed (red)
- vi) Low Oil Pressure (red)
- vii) Battery Charger Malfunction (red)
- viii) Low Battery Voltage (red)
- ix) Low Fuel (red)
- x) Auxiliary Prealarm (yellow)
- xi) Auxiliary Fault (red)
- xii) System Ready (green)

i) Test button for indicating lights.

j) Terminals shall be provided for each indicating light above, plus additional terminals for common fault and common prealarm.

8) Instrument Panel

a) The instrument panel shall include the following:

- i) Dual range voltmeter 3 1/2-inch, +/- 2% accuracy
- ii) Dual range ammeter 3 1/2-inch, +/- 2% accuracy.
- iii) Voltmeter-ammeter phase selector switch.
- iv) Lights to indicate high or low meter scale.
- v) Direct reading pointer-type frequency meter 3 1/2-inch, 0.5% accuracy, 45 to 65 Hz scale.
- vi) Panel-illuminating lights.
- vii) Battery charging voltmeter.
- viii) Coolant temperature gauge.
- ix) Oil pressure gauge.
- x) Running-time meter.
- xi) Voltage-adjust rheostat

9) Accessories

a) Line circuit breakers generator mounted as listed:

- i) 400 amperes (100% RATED), 400 amps sensor, 240 volt 3 phase rated, molded case type.

- b) Engine block heater. Thermostatically controlled and sized to maintain manufacturers recommended engine coolant temperature to meet the start-up requirements of NFPA-99 and NFPA-110, Level 1.
- c) A resettable line current sensing circuit breaker with inverse time versus current response shall be furnished which protects the generator from damage due to its own high current capability. This breaker shall not trip within the 10 seconds specified above to allow selective tripping of downstream fuses or circuit breakers under a fault condition. This breaker shall not automatically reset, preventing restoration of voltage if maintenance is being performed. a field current-sensing breaker will not be acceptable.
- d) Sound housings shall be as follows:
 - i) All enclosures are to be constructed from G60 galvanized high strength, low alloy steel
 - ii) The enclosure shall be primed with BASF urethane and finish coated with BASF Superior System paint. Enclosures will be finished in the manufacturer's standard color. Color shall be selected by Architect.
 - iii) The enclosures must allow the generator set to operate at full load in an ambient of 40°C with no additional derating of the electrical output.
 - iv) The enclosures must meet all of the requirements of UL-2200.
 - v) Enclosures must be equipped with sufficient side and end doors to allow access for operation, inspection, and service of the unit and all options. Minimum requirements are two doors per side. When the generator set controller faces the rear of the generator set, an additional rear facing door is required. Access to the controller and main line circuit breaker must meet the requirements of the National Electric Code.
 - vi) Doors must be hinged with stainless steel hinges and hardware and be removable.
 - vii) Doors must be equipped with lockable latches. Locks must be keyed alike.
 - viii) Enclosures must be mounted to the generator set skid.
 - ix) The enclosure roof must be pitched to prevent accumulation of water
 - x) A duct between the radiator and air outlet must be provided to prevent re-circulation of hot air.
 - xi) The complete exhaust system shall be internal to the enclosure. Enclosures with roof mounted or externally exposed silencers are not acceptable.
 - xii) The silencer shall be an insulated critical silencer with a tailpipe and rain cap
 - xiii) All acoustical foam must be fixed to the mounting surface with pressure sensitive adhesive. In addition, all acoustical foam mounted a horizontal plane must be mechanically fastened. The acoustical foam must have a protective film facing to act as a barrier for liquids
 - xiv) The enclosures must include an exhaust scoop to direct the cooling air in a vertical direction
 - xv) The maximum average sound level shall not exceed 76 dba at 7 meters (23 feet).
- e) Battery rack, and battery cables, capable of holding the manufacturer's recommended batteries, shall be supplied.
- f) 12-volt lead-antimony battery(ies) capable of delivering the manufacturer's recommended minimum cold-cranking Amps required at 0°F, per SAE Standard J-537, shall be supplied.
- g) 10-Ampere automatic float and equalize battery charger with +/- 1% constant voltage regulation from no load to full load over +/-10% AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambient temperatures from - 40°C to +60°C, 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected.
- h) Air cleaner restriction indicator to indicate the need for maintenance of the air cleaners.

- i) Engine crankcase emission canister.
- j) Remote annunciator panel enabling the generator status to be viewed remotely. This remote annunciator panel shall include a fourteen (14) relay dry contact box for connection to the controller terminal strip. The panel shall be flush mounted.
- k) Run Relay to provide a three-pole, double-throw relay with 10 amps at 250 VAC contacts for indicating that the generator is running.
- l) Common Failure relay to remotely signal auxiliary faults, emergency stop, high engine temperature, low oil pressure, overcrank, and overspeed via one single-pole, double-throw relay with 10 amps at 120 VAC contacts.
- m) Generator heater to prevent the accumulation of moisture for dampness in the generator windings.
- n) Generator prealarm senders.
- o) Generator exhaust manifold insulation blankets.
- p) Generator rodent guards.
- q) Generator skid end caps.

10. ACCEPTANCE

- A. Upon completion of the installation of the Emergency power system shall be tested to ensure conformity to the requirements of the standard with respect to both power output and function.
- B. The test shall be conducted after completion of the installation with all emergency power system accessory and support equipment in place and operating.
- C. The authority having jurisdiction shall be given advance notification of the time at which the final test is to be performed so that the authority can witness the test.
 - 1. With the prime mover in a “cold start” condition and the emergency load at standard operating level, a primary power failure shall be initiated by opening all switches or breakers supplying the primary power to the building or facility.
 - 2. The test load shall be that load that is served by the emergency power system.
 - 3. The time delay on start shall be observed and recorded.
 - 4. The cranking time until the prime mover starts and runs shall be observed and recorded.
 - 5. The time taken to reach operating speed shall be observed and recorded.
 - 6. The voltage and frequency overshoot shall be recorded.
 - 7. The time taken to achieve a steady-state condition with all switches transferred to the emergency position shall be observed and recorded.
 - 8. The voltage, frequency, and amperes shall be recorded.
 - 9. The prime mover oil pressure and water temperature shall be recorded, where applicable.
 - 10. The battery charge rate shall be recorded at 5-minute intervals for the first 15 minutes, and at 15-minute intervals thereafter.
 - 11. The load test with building load, or other loads (ie load bank) that simulate the intended load, shall be continued for the 2 hours maximum, observing and recording load changes and the resultant effect on voltage and frequency.

- 12. When primary power is returned to the building or facility, the time delay on retransfer to primary for each switch with a minimum setting of 5 minutes shall be recorded.
 - 13. The time delay on the prime mover cool down period and shutdown shall be recorded.
- E. After completion of the test performed in 7.13.4.1, the prime mover shall be allowed to cool for 5 minutes.
 - F. A load shall be applied for a 2-hour, full load test. The building load shall be permitted to serve as part or all of the load, supplemented by a load bank of sufficient size to provide a load equal to 100 percent of the nameplate kW rating of the EPS, less applicable derating factors for site conditions.
 - G. The data specified in D(1) through D(10) shall be recorded at first load acceptance and every 15 minutes thereafter until the completion of the 2-hour test period.
 - H. The following shall be made available to the authority having jurisdiction at the time of the acceptance test:
 - 1. Evidence of the prototype test.
 - 2. A letter of compliance.
 - 3. A manufacturer's certification of a rated load test at rated power factor with the ambient temperature, altitude, and fuel grade recorded

2.16 AUTOMATIC TRANSFER SWITCH

- 1) Submittal
 - i) The submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number, each required interconnection between the generator set and the transfer switch if it is included elsewhere in these specifications.
- 2) Testing
 - i) To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.
 - ii) Design Prototype Tests: Components of the emergency system such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and preproduction models, which will not be sold, shall have been used or the following tests.
- 3) Production Tests
 - i) Final Production Tests: Each transfer switch shall be tested under load with all guards in place. Tests shall include:
 - ii) The complete automatic transfer switch shall be tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency, and time delay settings are in compliance with the specification requirements.

- (1) The complete automatic transfer switch shall be subjected to a dielectric strength test per NEMA Standard ICS 1-109.05.
- (2) The control panel shall meet or exceed the voltage surge withstand capability in accordance with ANSI C37.90a-2978 and the impulse withstand voltage test in accordance with NEMA Standard ICS 1-109.

iii) Upon request, arrangements to either witness this test will be made, or a certified test record will be sent prior to shipment.

b) Site Tests

i) Site Tests: The manufacturer's local representative shall perform an installation check, start-up, and building load test. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test.

4) Warranty & Maintenance

- a) A one year warranty for the automatic transfer switch shall be included to guaranteed against defective material and workmanship in accordance with the manufacturer's published warranty from date of start-up. Optional warranties shall be available upon request.
- b) The automatic transfer switch manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall be regularly engaged in a maintenance contract program to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions, adjustment to the generator, transfer switch, and switchgear controls as required, and certification in the owner's maintenance log of repairs made and proper functioning of all systems.

5) Compliance With Codes and Standards

- a) The ATS shall conform to the requirements of:
 - i) UL 1008--Standard for Automatic Transfer Switches
 - ii) NFPA 70--National Electrical Code, including use in emergency and standby systems in accordance with Articles 517, 700
 - iii) NFPA 99--Essential Electrical Systems for Health Care Facilities
 - iv) NFPA 110--Standard for Emergency and Standby Power Systems
 - v) IEEE Standard 446--Recommended Practice for Emergency and Standby Power Systems (Orange Book)
 - vi) IEEE Standard 241--Recommended Practice for Electric Power Systems in Commercial Buildings (Gray Book)
 - vii) NEMA Standard IC10 (formerly ICS 2-447) Automatic Transfer Switches.
 - viii) UL 508 – Standard for industrial Control Equipment

ix) EN61000-4-5 Surge Immunity Class 4 (voltage sensing and programmable inputs only)

x) EN61000-4-4 Fast Transient Immunity Severity Level 4

xi) IEC Specifications for EMI/EMC Immunity as follows:

- (1) CISPR 1 Radiated Emissions
- (2) IEC 1000-4-2, Electrostatic Discharge
- (3) IEC 1000-4-3, Radiated Electromagnetic Fields
- (4) IEC 1000-4-4, Electrical Fast Transient (Bursts)
- (5) IEC 1000-4-5, Surge Voltage
- (6) IEC 1000-4-6, Conducted RF Disturbances
- (7) IEC 1000-4-8, Magnetic Fields
- (8) IEC 1000-4-11, Voltage Variations and Interruptions

6) Electrical Requirements

- a) Automatic transfer switches not intended for continuous duty or repetitive load transfer switching are not acceptable.
- b) The automatic transfer switch shall be rated in amperes for total system transfer including control of motors, electric-discharge lamps, electric heating, and tungsten-filament lamp load. Switches rated 400 amperes and below shall be suitable for 100% tungsten-filament lamp load. Switches rated above 400 amperes shall be suitable for 30% tungsten-filament load.
- c) The automatic transfer switch shall be rated to withstand the rms symmetrical short circuit current available at the automatic transfer switch terminals, with the type of overcurrent protection shown on the plans.

7) Equipment

- a) The transfer switches shall have the following characteristics:
 - i) amp current rating as shown on drawings
 - ii) 3 Pole
 - iii) 4 wire, 3 phase
 - iv) 208 Volt-60Hz
 - v) Solid Neutral
 - vi) The withstand and closing ratings with a current-limiting fuse shall be 200,000 Amps
 - vii) The withstand and closing ratings with any overcurrent protective device shall be 50,000 Amps
- b) The ATS shall be furnished in a NEMA 1 enclosure.
- c) The switch shall be a 600 volt class.

8) Mechanical Requirements

- a) All main contacts shall be of silver composition. The main contacts shall be protected by arcing contacts in sizes 400 amperes and above. The main contacts shall be of the blow-on configuration and of segmented construction in ratings 600 amperes and above.
- b) All contacts, coils, springs, and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.
- c) The contact transfer time shall not exceed one-sixth of a second.
- d) All moveable parts of the operating mechanism shall remain in positive mechanical contact with the main contacts during the transfer operation without the use of separate mechanical interlocks.
- e) All contacts, coils, springs, and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.
- f) The neutral conductor shall be solidly connected as shown on the plans, a neutral conductor terminal plate with fully rated AL-CU pressure connectors shall be provided.

9) Transfer Switch Control System

- a) The control module shall direct the operation of the transfer switch. The module's sensing and logic shall be a built-in microprocessor-based system for maximum reliability, minimum maintenance, and inherent digital communications capability. The control settings shall be stored in nonvolatile EEPROM. The module shall contain an integral battery-backed programmable clock and calendar. The control module shall have a keyed disconnect plug to enable the control module to be disconnected from the transfer mechanism for routine maintenance.
- b) The control module shall be mounted separately from the transfer mechanism unit for safety and ease of maintenance. Interfacing relays shall be industrial control grade plug-in type with dust cover.
- c) The control module shall include a user interface keypad with tactile feedback pushbuttons and light-emitting diode status indication. These features shall be user accessible when the enclosure door is closed:
 - i) Keypad pushbuttons:
 - (1) Start/end system test
 - (2) Set/end exercise
 - (3) End time delay
 - (4) Lamp test/service reset
 - ii) Light-emitting diode status indicators:
 - (1) Contactor Position: Normal, Off, Emergency
 - (2) Source Available: Normal, Emergency
 - (3) Service required: immediate, maintenance
 - (4) Not in automatic mode
 - (5) Four stage time delay remaining
 - (6) Exercise: load, no load, set/disabled
 - (7) Test: load, no load
 - (8) Load control active: peak shave, load shed, pre/post-transfer signal

(9) In-phase monitor active

d) Outputs:

- i) Generator engine start gold flashed contact rated 2 amps @ 30 VDC/250VAC.
- ii) Pre-transfer load control, one normally open contact rated 10 amps @ 30 VDC/250 VAC
- iii) One Programmable output, factory-set to load bank control rated 2 amps @ 30 VDC/250 VAC.

10) Operation

a) All phases of normal and all phases of emergency shall be monitored for over and under voltage and single phase of normal and emergency for over- and under-frequency. In addition, the controller shall use anti-single phasing protection that detects regenerative voltage (using the phase angle of the source) to determine a failed source condition.

b) Voltage and frequency sensing:

- i) Undervoltage pick-up set at 90% of nominal voltage, adjustable 85% - 100% of nominal voltage.
- ii) Undervoltage dropout set at 90% of pickup voltage, adjustable 75% - 98% of pickup voltage.
- iii) Overvoltage dropout set at 110% of nominal voltage, adjustable 105% - 135% of nominal voltage.
- iv) Overvoltage pick-up set at 95% of dropout voltage, adjustable 85% - 100% of nominal voltage.
- v) Voltage dropout time set at 0.5 seconds adjustable 0.1 – 9.9 seconds.
- vi) Voltage accuracy: 2%.

- vii) Under frequency pick-up set at 90% of nominal frequency, adjustable 85% - 95% of nominal frequency.
- viii) Under frequency dropout set at 99% of pick-up frequency, adjustable 95% - 99% of pick-up frequency.
- ix) Over frequency dropout set at 101% of pick-up frequency, adjustable 101% - 105% of nominal frequency.
- x) Over frequency pick-up set at 110% of nominal frequency, adjustable 105% - 120% of nominal frequency.
- xi) Frequency accuracy: 1%

c) Time Delays:

- i) Time delay for engine start to delay initiation of transfer for momentary source outages: Range 0-6 seconds. Factory set at 3 seconds.
 - ii) Time delay for transfer to standby: Range 0-60 minutes. Factory set at 1 second.
 - iii) Time delay for transfer back to normal: Range 0-60 minutes. Factory set at 15 minutes.
 - iv) Time delay for engine cool down: Range 0-60 minutes. Factory set at 0 minutes.
 - v) Failure to acquire standby source: Range 0-60 minutes. Factory set at 1 minute.
 - vi) Pre-transfer to normal signal: Range 0-60 minutes. Factory set at 3 second.
 - vii) Pre-transfer to standby signal: Range 0-60 minutes. Factory set at 3 second.
 - viii) Post-transfer to normal signal: Range 0-60 minutes. Factory set at 0 minute.
 - ix) Post-transfer to standby signal: Range 0-60 minutes. Factory set at 0 minute.
- d) User terminals shall be available to connect a normally open contact that, when closed, signals the control module to start and transfer load to the engine-generator. Opening these contacts shall initiate a retransfer and engine cool down sequence. The load shall be transferred to an available utility source immediately if the generator source should fail.
- e) The following features shall be built into the control module logic. These features shall be enabled at the factory or in the field.
- i) Phase rotation sensing programmable ABC or CBA.
 - ii) In-phase monitoring shall continuously monitor the contactor transfer times, source voltage, frequency and phase angle to provide a self-adjusting, zero crossing contactor transfer signal. A flashing LED on the user interface panel shall indicate active in-phase monitoring.
 - iii) Plant Exerciser: Programmable seven-day or fourteen-day exerciser with user selectable load or no-load operation. An LED, on the user interface, shall indicate the type of exercise (load or no load). The time remaining on the exercise shall be indicated. The exercise time may be reset at any time with a single keystroke. The engine shall be allowed to run when the exercise period is terminated. The exerciser may be disabled for maintenance purposes. An amber LED shall flash on the user interface if the exerciser has been disabled. The exerciser shall have the capability of being programmed, using up to twenty-one (21) event for a calendar mode. The controller shall have provisions for disconnecting a load bank (during exercise) if there is a loss of normal power.
 - iv) The control module must be upgradeable with the following options
 - (1) Preferred source switch
 - (2) Supervised transfer control switch
 - (3) Line to neutral voltage monitoring

- (4) Provide four programmable input/output (I/O) modules with two inputs and six outputs each rated 2 amps @ 30 VDC/250 VAC

11) Monitoring, Programming and Communications:

- a) Modbus® link:
 - i) Industry standard Modbus® RTU communication shall be available with network and setup connections.
 - ii) A Modbus® master will be able to monitor controller data.
 - iii) A Modbus® master will be able to alter parameters.
 - iv) The Modbus® master must be capable of starting and stopping the generator.
 - v) The manufacturer shall provide a Modbus® communications protocol manual to facilitate communications with a Modbus® master by a third party developer.
 - vi) The Modbus® network shall communicate to the controller using a twisted pair of wire.
- b) It shall be possible to start the generator and transfer the loads to the generator.
- c) Event monitoring shall be accessible using either a personal computer with the personal computer software or Modbus® link to view the following:
 - i) Historical data (total and resettable)
 - (1) Days in operation
 - (2) Hours in standby
 - (3) Hours not in preferred
 - (4) Switch transfers
 - (5) Failure to transfer
 - (6) Transfers due to loss of preferred
 - (7) Start up date
 - (8) Last maintenance date
 - (9) Switch transfer count since last maintenance
 - ii) Transfer switch information
 - (1) ATS serial number
 - (2) Controller serial number
 - (3) Contactor serial number
 - (4) Load description
 - (5) Location
 - (6) Branch
 - (7) Network connection ID
 - (8) Baud rate
 - (9) Parity bit

- iii) System events (time and date stamped) of the last 100 events which include all failures of the sources, transfer switch and all functions of the controller and contactor:
 - iv) Line to line voltage
 - v) System frequency
 - vi) Time delay active
 - vii) Time delay remaining
 - viii) System status
 - ix) Source available
 - x) Contactor position
 - xi) Exerciser schedule, mode and time remaining on active exercise.
- d) Programmable features may be viewed, selected or adjusted as follows:
- i) System voltage
 - ii) System frequency
 - iii) Single/three-phase operation
 - iv) Open/closed-transition operation
 - v) ABC or CBA phase rotation
 - vi) In-phase monitor
 - vii) Commit/no commit transfer mode
 - viii) User defined password
- e) Programmable inputs shall be defined using either a personal computer with the personal computer software or Modbus® link:
- i) End time delay input
 - ii) Inhibit transfer
 - iii) Low external battery fault
 - iv) Peak shave/area protection input
 - v) Remote common fault
 - vi) Remote test
- f) Programmable outputs shall be defined using either a personal computer with the personal computer software or Modbus® link:
- i) Auxiliary switch fault
 - ii) Common fault
 - iii) Contactor position
 - iv) Exercise active
 - v) Failure to acquire standby source
 - vi) Failure to transfer fault
 - vii) Generator engine start
 - viii) Load bank control
 - ix) Loss of phase fault

- x) Low backup battery
- xi) No in automatic mode
- xii) Non-emergency transfer
- xiii) Over and undervoltage faults
- xiv) Over and under frequency faults
- xv) Peak shave/area protection active
- xvi) Phase rotation error
- xvii) Modbus®-controlled relay outputs
- xviii) Source available
- xix) Test active

2.17 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect and/or Engineer.

PART 3 - EXECUTION

3.1 EXISTING CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.
- B. Demolition/relocation: Contractor shall perform all demolition/relocation as required to complete construction as indicated on the Drawings. Consult Owner before disposing of removed equipment.

3.2 PREPARATION

- A. Coordinate:
 1. Coordinate as necessary with other Sections.
 2. Coordinate the installation of electrical items with the schedule for work of other Sections to prevent unnecessary delays in the total Work.
 3. Where lighting fixtures and other electrical items are shown in conflict with locations of structural members and mechanical or other equipment, provide required supports and wiring to clear the encroachment.
- B. Data indicated on the Drawings and in these Specifications are as exact as could be secured, but their absolute accuracy is not warranted. The exact locations, distances, levels, and other conditions will be governed by actual construction and the Drawings and Specifications should be used only for guidance in such regard.
- C. Where outlets and equipment are not specifically located on the Drawings, locate as determined in the field by the Architect. Where outlets and equipment are installed without such specific direction, relocate as directed by the Architect and at no additional cost to the Owner.
- D. Verify all measurements at the Building. No extra compensation will be allowed because of differences between work shown on the Drawings and actual measurements at the site of construction.
- E. The Electrical Drawings are diagrammatic, but are required to be followed as closely as actual construction and work of other Sections will permit. Where deviations are required to conform with

actual construction and the work of other Sections, make such deviations without additional cost to the Owner.

3.3 TEMPORARY POWER AND LIGHTING

- A. General: In coordination with and in addition to the General Conditions of these Specifications provide the following:
1. Provide temporary power and lighting to all areas of construction. All work areas must have (2) 120V Duplex GFI outlets available within 80 feet.
 2. Provide three phase and single-phase power for construction as required.
 3. Provide temporary power to all site construction trailers as required. Provide transformers as required.
 4. Minimum lighting level to be 40 F.C. at work areas.
- B. Maintenance:
1. The temporary wiring system shall be maintained by the Electrical Contractor, including lamp replacement, fuses, circuit breakers, sockets, plugs, receptacles, etc. as required during construction of the project shall be maintained by the Electrical Contractor. In addition, Contractor shall insure that temporary wiring is not used for heating.
 2. Should any part of the permanent electric system be used during building operations, the Electrical Contractor shall make all replacements made necessary by such use and shall be responsible for all damage to existing electric systems used, and shall make good such damage to the satisfaction of the Engineer.
 3. When the electrical lines are no longer required, they shall be removed.
 4. All temporary electrical equipment (feeders, wiring, panels, lighting, outlets, distribution equipment, etc.) shall be removed.
- C. Wiring:
1. All wire shall be insulated and shall be installed without hazardous conditions of any nature. Installation shall be in accordance with article 305 of the NEC and the Federal Register Safety and Health Regulations for construction. Wire sizes shall provide a minimum of 110 volts at all outlets under all conditions of operation.
 2. Ground: Provide ground fault protection per code for all receptacles either via GFI circuit breakers or GFI receptacles.
 3. Voltage Drop: Feeders and branches shall be of sufficient size to insure correct operation of all connected equipment and to meet code.
 4. Power Outlets: 208 Volts, 3 phase power outlets shall be provided as required.

3.4 MASONRY AND OTHER PENETRATIONS

- A. Provide sleeves and or patching for each conduit passing through walls, partitions, floors, roofs, and ceilings.
1. Set conduit sleeves in place before concrete is placed, wherever possible.
 2. Provide sleeves two pipe sizes larger than the conduit passing through, or provide a minimum of 1/2" clearance between inside and outside of the conduit.
 3. Provide a waterproof installation for sleeves in floors, see Drawing details.
- B. Caulk the space between sleeve or wall and conduit, using a noncombustible, permanently plastic, waterproof, non-staining compound which leaves a smooth finished appearance, or pack with noncombustible mineral wool, or fiberglass to within 1/2" of both wall faces, and provide the waterproof compound described herein. Smooth up rough edges around sleeves.

- C. Provide all cutting and patching, fire caulking and sealing, to standards of other Sections and Divisions and all applicable codes.
- D. Where conduits and other work of this section pass through fire rated walls, provide proper fire stops to maintain rating in accordance with local codes.
- E. Where conduits pierce the roof, provide 24 gage galvanized iron roof jacks and flashing collar brazed onto the conduits and covering the top of the roof jacks.
- F. Caulk all floor penetrations with fire retardant material meeting ASTM E-814 and UL 1479 Fire Test Standards. Metcaulk or authorized equal.
- G. Do not run conduit in the cavity of any exterior brick or block walls, masonry or masonry veneer walls.

3.5 TRENCHING AND BACKFILLING

- A. Perform trenching and backfilling associated with the work of this section in strict accordance with the standards of other Sections of this contract.
- B. Cut bottom of trenches to grade. Make trenches a minimum of 12 inches wider than the greatest dimension of the conduit to be installed.
- C. Bedding and backfilling:
 - 1. Install conduit promptly after trenching. Keep trenches open as short a time as practicable.
 - 2. Under the building, install conduits on a 6" bed of authorized compacted damp sand. Fill to bottom of slab with 6" layers of authorized compacted damp sand.
 - 3. Outside the building, install underground conduits on a 6" bed of damp sand. Fill to within 12" of finish grade with 6" layers of compacted damp sand. Backfill remainder with native soil.
 - 4. Do not backfill until the installation has been inspected by AHJ and until Project Record Documents have been properly annotated.
- D. All underground conduits PVC of code authorized schedule with waterproof joints.

3.6 INSTALLATION OF RACEWAYS AND FITTINGS

- A. Where conduit is installed concealed in walls or above the ceiling, or exposed in work areas, provide rigid galvanized conduit where appropriate.
 - 1. Paint or wrap elbows.
 - 2. Seal joints to prevent entrance of water.
 - 3. Provide ground wire of proper size.
 - 4. Use nylon (rather than steel) fish tape.
- B. Where conduit is exposed in work areas, provide rigid galvanized conduit. Coordinate all exposed conduit with Architect.
 - 1. Seal joints to prevent entrance of water.
 - 2. Provide ground wire of proper size.
 - 3. Use nylon (rather than steel) fish tape.
- C. Run all conduit parallel to or at right angle with lines of the building.
 - 1. Make bends with standard conduit elbows or conduit bent to not less than the same radius.

2. Make bends free from dents and flattening.
- D. Securely and rigidly support conduits throughout the Work.
 - E. Exposed conduit and raceway on truss work shall be mounted above chords or held tight to truss, mount on least populous side of member. Special care shall be taken to conceal all raceways in all areas.
 - F. All conduit shall be 10' lengths and each 10' length shall contain the Underwriter's label showing the conduit has been manufactured for that purpose. Conduit shall be sized as required by latest National or Local Code applicable for equivalent number of THW conductors. The type to be used and their installation shall be as in item G below.
 - G. In general, provide all conduit to 5'-0" beyond building for outside work (except service), and provide junction box of suitable size, with cover on nearest convenient, interior and location, generally shown, cap conduit or interconnect outboard to the sitework conduit.
 - H. Galvanized heavy wall steel conduit shall be used for all sweeps, and for above floor conduit extensions from the sweeps to the panels or outlet boxes. (No PVC is to be used above ground for powered electrical circuits.)
 - I. Expansion Fittings: All conduit crossing expansion joints shall be provided with expansion fittings located adjacent to the point of their crossing such joints. Expansion fittings shall be of the same size as the conduit in which they occur. Conduits shall be solidly anchored within 24" of both ends of all expansion fittings, and jumpered with O.Z. type "BJ" bonding jumper.
 - J. Flexible Steel Conduit: Use 1/2" minimum, except where noted otherwise. Flexible conduit shall be used for the following applications only:
 1. For final connection to motor terminal box, max. length 18"
 2. For final connection to outlets on vibrating equipment
 3. From outlet box to recessed lighting fixture minimum 4', maximum 6' length.
 4. For short connections as authorized by the Engineer.
 5. For expansion joint crossings.
 6. For weatherproof installations, with polyvinyl sheathing, similar to American Metal Hose "Sealtite" type "UA" or equal.
 - K. PVC Conduits: With proper size equipment ground wires and galvanized steel elbows, for the panel feeder conduits, branch circuit conduits and telephone conduits, under the floor slab.

3.7 INSTALLATION OF LIGHTING FIXTURES AND LAMPS

- A. General:
 1. Lighting and Fixtures shall, by definition, include all fluorescent, incandescent, wall bracket, chandelier, and/or other lighting assemblies used for general, accent, or decorative illumination. Lighting fixtures and lamps shall be furnished and installed by the Electrical Contractor. The Electrical Contractor shall be completely responsible for all lighting fixtures and lamps from the time of receipt until the finished building is turned over to the Owner (See Electrical Drawings for fixture and lamp location, type, manufacturer, etc.)
 2. The Electrical Contractor shall obtain shop drawings, approvals, order and receive all lighting fixtures and lamps that are delivered to the job site, inspect same, and refer all claims for shortage and/or damage to the shipper immediately for all required adjustments.

3. All damaged and/or missing fixtures and lamps shall be replaced and repaired by the Electrical Contractor at his expense. All lighting fixtures and lamps shall be stored in one area. The Electrical Contractor shall coordinate with the General Contractor's Job Superintendent to establish this storage area in the best possible location.
 4. The Electrical Contractor shall keep the fixture supplier informed so that all fixtures and lamps can be delivered to the job site when required.
- B. Install lighting fixtures complete and ready for service in accordance with the Drawings:
1. Continuous row fluorescent fixtures shall be wired from one outlet located at the end of the specific row and wired through the chassis connecting the indicated circuit as shown on the drawings. The Electrical Contractor shall be responsible for investigation with the Electrical Inspection Authorities to assure that through-chassis wiring is permitted. If through-chassis wiring is permitted, no compensation for error of drawings as to the actual number of outlets required.
 2. Wire fixtures with fixture wiring of at least 105° C rating. Where fixtures are mounted in continuous rows, provide conductors in wiring channels of the same size as the circuit wires supplying the row of fixtures.
 3. Use only bonderized, galvanized, or sherardized steel for fixture installation for protection against rust and corrosion, and install fluorescent fixtures straight and true with reference to walls.
 4. Install all lighting fixtures, so that the weight of the fixture is supported, either directly or indirectly, by a sound and safe structural member of the building, using adequate number and type of hangers and fasteners to assure safe installation.
 - a. Screwed fastenings and toggle bolts through ceiling material or wall paneling are not acceptable.
 - b. Do not support from sub-purlins of panelized roof systems.
 5. Single fixtures shall have an outlet box provided for each fixture unless within 4'-0" of outlet box, accessible per code.
 6. Special Mounting: When mounting fixtures to rocklath, acoustical or gypsum board ceilings, the Electrical Contractor shall provide and install mounting hardware or angles and secure the fixtures to framework above. When mounting surface or pendant type fixture to metal lath and plaster, they shall be secured per code. When locating outlets in suspended grid ceilings, the Electrical Contractor shall consult and cooperate with the Acoustical Contractor to assure correct placement of fixtures in the grid. Authorized slips may be used as fixture support below suspended grid ceilings when the "T" bars are adequate to support the load, with the cost of such additional support by the Electrical Contractor. For gypsum board ceilings, coordinate location with reflected ceiling plans.
 7. Plaster Rings, when recessed fixtures require plaster frame or ring, the Electrical Contractor shall deliver them to the General Contractor 30 days prior to the lathing operation.
 8. Recessed Fluorescents: The Electrical Contractor shall not install any fixtures until the ceiling Contractor has provided adequate support to the suspended ceiling, as necessary. In the event of inadequate support, the job superintendent shall be notified by the Electrical Contractor. After adequate support has been provided, the Electrical Contractor may proceed to install fixtures. Adequate support means a minimum of a wire on the grid at each corner of fixture.
 9. Recessed Fixtures: Fixtures shall not leak light to below and all trim shall be tight to ceiling.
 10. Adjust all adjustable type, to highlight, "appointments" generally in direction of arrows on plan.
 11. Ballasts: The Electrical Contractor shall be responsible for replacing all defective fluorescent fixture ballasts during the construction period and guarantee period. Ballasts shall be of the UL Class "P" type with high power factor, low energy loss, Jefferson or equal, with Klixon overwarrant protection. Ballasts shall supply not more than two lamps,

but may utilize a two-lamp ballast, where practical, in lieu of single lamp ballasts. Interwire to suit, where necessary.

12. Lamps: Provide lamps per schedule on drawings for all fixtures and replace all units burned out during construction. If utilized for general lighting, all 750-hour lamps shall be replaced new at time of turnover. Fluorescent lamps shall be, "warm white", of the 34 or 35 watt energy saver type, G.E. "Watt-Miser", or equal and similar for the 36" lengths.

C. Controls:

1. Extent of this contract includes all required relays, contactors and control wiring brought to a "transponder terminal box". Each such box shall be labeled and shall contain sufficient terminal blocks (+20% spare) to terminate all control system wires. Terminal blocks shall be UL, CSA, authorized, 600-volt type of Cogenal, Inc., Spring Valley, NY. Entelec 5000, or equal. All wires shall be labeled with Burndy or equal designations. Boxes shall be hinged cover, NEMA I with complete wire code-termination information in a clear plastic envelope adhered to inside of cover. Control wires shall be #14 AWG for runs up to 100 ft. and #12 AWG for longer runs. Terminate and code each control wire on the blocks.
2. Jumpers from terminals, transponders, loop cable, and central processor will be by others.
3. Generally, boxes shall be located in concealed locations or at 7 1/2' height in finished areas, accessible for connections or in unfinished areas. Contractor is to determine actual number of wires based on final authorized control equipment.

3.8 INSTALLATION OF POWER EQUIPMENT

- A. Provide power wiring for panels and equipment as shown on the Drawings or as required for a complete installation.
- B. Connections to miscellaneous building equipment:
 1. Wire to, and connect to, all items of building equipment provided under this and other sections of this contract not specifically described but to which electrical power is required.
 2. Coordinate as necessary with other trades and suppliers to verify types, numbers, and locations of equipment.
- C. Provide motor starters and switches mounted in NEMA type 1 or type 3R enclosures for Exhaust Fans and any other equipment not provided with starters by the manufacturer.

3.9 INSTALLATION OF CONDUCTORS

- A. Except for alarm and signaling systems and unless otherwise shown on the Drawings, the minimum conductor size will be No. 12 for all branch circuits. When necessary use larger wire sizes to prevent voltage drops.
 1. Where wire size is not shown, install conductors sized to loads.
 2. Where conduit size is not shown, size to wire and load.
 3. Provide code-sized conduit for number and size wires shown or required, unless a larger size conduit is shown on the Drawings.
 4. Support all conduit, junction boxes, etc., from building structure only.
 5. Color code: Insulation is to be colored as follows:
 - a. 120/208 volt system:

"A" phase	- Black
"B" phase	- Red
"C" phase	- Blue
 - b. Neutral Conductor (120/208 systems) - White
 - c. Equipment Ground Conductor (all systems) - Green

- B. All branch circuits to be rigid conduit or EMT in accordance with other Sections of this Specification.
 - 1. Exception: flexible metal conduit will be allowed for tap connections to the lighting fixtures to allow the fixtures to be lifted out of the way. 3/8"-minimum diameter with high-temp wiring, to be allowed as per code.
 - 2. Other wiring methods as authorized by the Engineer.
- C. Use identified (white) neutrals and color-coded phase wires for all branch circuit wiring.
 - 1. Make splices electrically and mechanically secure with pressure-type connectors.
 - a. For wires size 6 AWG and smaller, provide "Scotch-Lock" type connectors.
 - b. For wire size 4 AWG and larger, provide Burndy "Versitaps" and heavy-duty connectors, or T & B "Lock Tite" connectors.
 - 2. Insulate splices with a minimum of three half-lapped layers of Scotch Brand No.33 vinyl-plastic electrical tape where insulation is required.
- D. Tape all joints with rubber tape 1-1/2 times the thickness of the conductor insulation, then cover with the friction tape or the vinyl-plastic electrical tape specified above.
- E. The Drawings are a general indication of the direction of home runs. Continue all such home runs to the panel as though the routes were shown completely.

3.10 INSTALLATION OF WIRING DEVICES

- A. Mounting Height: (Outlets) - The Electrical Contractor is to coordinate locations of all outlets on walls, columns, etc. with field conditions, so that the outlet does not occur at junction of different materials in wall finishes, on molding, break in wall surface, or other unsuitable locations. The following mounting heights shall be used unless indicated otherwise on Drawings. Note: Mounting height is the distance from finished floor line to center line of outlet. All heights and locations shall be verified with Architect before installation.

1. Ceiling level receptacles and wall outlets	8'-6"	
For fixtures (above grade)		
2. Receptacles, (to bottom of box)	15"	
3. Telephone outlets (coordinate with Tele. Co.)		15"
4. Wall flush switches, general, top of box	44"	

3.11 INSTALLATIONS OF OUTLETS AND BOXES

- A. Outlets:
 - 1. Install to bear evenly and truly, secured on axis of supporting members.
 - 2. Where boxes are back of finished surface, use recessed boxes and proper length screws, of size to form shoulder at exact point to retain switch in position. Use no wooden wedges, shims or blocks for truing up.
- B. Outlet Boxes:
 - 1. Locations indicated for local wall switches are subject to modifications. At or near doors install switch on side opposite hinge. Verify final door hinge location in field prior to switch outlet installation.
 - 2. Set boxes square and true with building finish. Contractor shall erect wall and switch outlets in advance of furring and fireproofing. Secure to building structure or steel by adjustable strap irons.

3. Verify locations of outlets and switches in finished rooms with drawings of interior details and finish. In centering outlets and locating boxes allow for overhead pipes, ducts and mechanical equipment, variations in fireproofing and plastering, window and door trim, paneling, hung ceilings, and the like, and correct any inaccuracy resulting from failure to do so without expense to Owner.

C. Ceiling Outlet Boxes:

1. Install flush with ceiling. Bar hangers or chain suspension from the joists shall be used in the stock areas. Pull chain cords shall be continuous, complete with bell and no more than 6'-0" from floor.
2. Boxes shall be secured with lead anchors or beam clamps as required with all thread rod or authorized equal. A workmanlike installation shall prevail.

D. Junction and Pull Boxes:

1. Provide pull boxes wherever necessary to facilitate pulling of wire and/or as indicated on Drawings. Coordinate location with other trades to assure that covers will be fully accessible, free from any and all obstruction when building is complete.
2. Junction and pull boxes shall be located so as not to be exposed in finished areas. (Preferred location in accessible ceiling spaces).
3. Support junction and pull boxes directly to building structure with no weight bearing on conduits.
4. Outlet boxes for lighting fixtures recessed in hung ceilings shall be accessible through opening created by removal of fixture or adjacent ceiling tile.

3.12 SUPPORTS, INSERTS AND HANGERS

- A. The Electrical Contractor shall provide all supports, inserts, and hangers for conduits, cables, lighting fixtures, cabinets and other electrical equipment. Inserts and hangers shall be Powerstrut, Kindorf, Unistrut, or Elcen.
- B. Pipe straps shall be used for wall mounting conduit. Pipe straps shall be used for wall mounting conduit. Pipe straps shall be steel, single-hole type. Pipe straps, fixtures and cabinets shall be secured to the wall by means of screws, toggle-bolts, lag screws in metal expansion shield or other authorized method. Wooden plugs shall not be used.
- C. All overhead conduits shall be supported from the structural beams. Grouped conduit supports shall be steel channel attached to structural beams with proper size beam clamps. Channel may be suspended below structural beams with proper size beam clamps and 3/8" continuous threaded hanger rods installed (maximum) 2'-0" on center for the entire length of channel. Conduit shall be secured to channel with single bolt 2 piece channel pipe clamps for 1-1/4" and larger conduits and strut clips similar to "Caddy" number 12MFA clips for 1" and smaller conduits. Individually supported conduits shall be secured to structural beams with proper size beam clamps and one piece pipe hanger clamps with closure bolt similar to "Kindorf" 6HB series, for 1-1/4" and larger conduits, and combination conduit hanger clamps similar to "Caddy" #16-M-5-8 for 1" and smaller conduits.
- D. Welded studs may be used for attachment to steel members, but conduits shall not be welded directly. Tie wire shall not be used to support or secure conduit.
- E. Authorized manufacturers of channel are Powerstrut, Unistrut, and Kindorf. Authorized manufacturers of conduit clamps are Powerstrut, Unistrut, Kindorf, Minerallac, and Caddy.
- F. NOTE: Electrical Contractor shall be responsible for determining proper size clamps for the various conduit sizes and beam flange thickness encountered.

- G. Conduits shall not be supported by ceiling grid. They shall be supported directly by the building structure.
- H. Pass raceways over water, steam or other piping where pull boxes are not required. No raceway within three inches of steam and hot water pipes, or appliances, except at crossings where raceway shall be at least one inch from pipe cover. Install raceway to prevent collection of trapped condensation and be devoid of traps.

3.13 INSTALLATION OF PANELS

- A. Unless otherwise shown on the Drawings, install panels with the top of the trim 6'-3" above the finished floor.
- B. Mount a typewritten directory behind glass or plastic on the inside of each panel door and, on the directory, show the circuit number and complete description of all outlets on each circuit.
- C. Panelboard Spare Conduits shall be furnished and installed by the Electrical Contractor when a panel is either recessed, or furred-in. These conduits shall be sized to provide capacity for future wiring of all spares within the panel. Run conduits from panel to accessible ceiling space. Provide a minimum of 3 1" conduits per panel.
- D. Cabinets for relays may be appended to panels, cabinets or may be separate. Where necessary, they shall be full width. Cabinets shall include hinged door and latch.
- E. Panels shall be recessed in corridors and wherever possible.

3.14 TESTING AND INSPECTION

- A. Provide personnel and equipment, make required tests, and secure required approvals from the Engineer and governmental agencies having jurisdiction.
- B. Make written notice to the Engineer adequately in advance of each of the following stages of construction:
 - 1. When all rough-in is complete, but not covered;
 - 2. At completion of the work of this Section.
- C. When material and/or workmanship is found not in compliance with the specified requirements, then within three days after receipt of notice of such noncompliance, remove the non-complying items from the job site and replace them with items complying with the specified requirements, all at no additional cost to the Owner.
- D. Upon completion of work, test installation for ground and short circuits. Test all feeders and 10% of each of other electrical system wiring. If tests indicate faults, further tests shall be conducted as required by the Engineer. Resistance between conductors

No. 6, 4, & 3	100,000 OHMS
No. 2, 1, 1/0, 2/0 & 3/3	50,000 OHMS
No. 4/0, 250,300,350 & 500 MCM	25,000 OHMS
No. 750 MCM and larger	12,000 OHMS

3.15 DEBRIS REMOVAL

- A. Provide in accordance with Section 01500.

3.16 PROJECT COMPLETION

- A. Upon completion of the work of this Section, in accordance with Section 01900, thoroughly clean all exposed portions of the electrical installation, removing all traces of soil, labels, grease, oil, and other foreign material, and using only the type cleaner recommended by the manufacturer of the item being cleaned.
- B. Per Section 01900, thoroughly indoctrinate the Owner's operation and maintenance personnel in the operation and maintenance of all equipment installed under this Section. As a minimum, a one-day session is to be scheduled at the conclusion of this project for this purpose.

PART 4 - SITE ELECTRICAL WORK

4.1 GENERAL

- A. Sitework includes providing of all material and labor for underground conduit and wire complete. Accepting delivery of light poles, luminaires and lamps, storing, protecting, installing, connection, lamping, testing, adjusting and repairing all poles and luminaires.
- B. Conduit systems generally terminate or connect to building system conduit at approximately 5'-0" from building and wiring to be generally carried to a splice location within the building.
- C. Manholes, handholes and light pole bases and similar underground precast structures are included as well as all necessary coordination with all other utilities.
- D. Provide all required precast work, hardware, excavation and backfill associated with site electrical work, Manholes, handholes and transformer bases are considered precast work.

4.2 SITE POWER AND LIGHTING

- A. Provide complete underground conduit cable and associated structures, and make all final connections.
- B. Furnish and install all lighting equipment, accept delivery rejecting all damaged or faulty equipment. Unload, store and protect all undamaged items, making good any later damaged and/or stolen parts. Contractor shall furnish, install and coordinate location of pole bases and anchor bolts. Base bolt covers and all exposed hardware will be pre-painted with enamel. Obtain matching paint from supplier of poles. Contractor is responsible for touch-up painting of any marred, surfaces, particularly after rigging into place.
- C. Provide anchor bolts, bolt template and orientation information, (and checking of same), and concrete base. Verify bolt height information as well. Note orientation shown on site electrical plan.
- D. Contractor shall lamp and pretest to insure operation, rig into place and install within 1" of plumb, at top, in both directions. Make all final connections, final tests, repairs, adjustments etc. and guarantee installation.
- E. Install 300# test nylon rope in all empty conduit.
- G. Provide anchor bolts, splice boxes, and conduits to cast in place concrete Contractor. Coordinate in detail to assure proper installation and fit with light poles.

4.3 UNDERGROUND CONDUIT WORK

- A. Trenches for ducts may be excavated manually or with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of shoulder surface is disturbed. Blades of road patrols or graders shall not be used to excavate the trench. The Contractor shall ascertain the type of soil to be excavated before bidding.
- B. Unless otherwise shown, PVC ducts for direct burial shall be installed so that tops of ducts are 30 inches below grade unless concrete encased. Minimum Schedule 40 rating. Where ducts pass through embankment in pavement areas, the embankment shall first be constructed to its full depth, and then re-excavated as required for the installation of the duct, and compacted to original densities without the use of heavy grading equipment.
- C. Unless otherwise shown in the plans, concrete-encased ducts shall be installed so that the top of the concrete envelope is not less than 12 inches below the finished grade where installed under paved areas, and not less than NEC Code minimum below finished grade where installed in unpaved areas. Concrete encased ducts under paved areas shall extend at least 3 feet beyond the edges of the pavement or 5 feet beyond any piping system which may be installed in the paved area. Trenches for concrete-encased ducts shall be opened the complete length before concrete is laid so that if any obstructions are encountered, proper provisions can be made to avoid them. Where two or more ducts are encased in concrete, the Contractor shall space them not less than 1-1/2" apart (measured from outside wall to outside wall) using spacers applicable to the type of duct. As the duct laying progresses, concrete not less than 2 inches thick shall be placed around the bottom, sides and top of the duct bank. End bells of couplings shall be installed flush with the concrete encasement where required. Steel conduit having 40 mil PVC jacket on galvanized conduit and fittings may be utilized in lieu of concrete encasement, and installed to above depths.
- D. Trenches for non-encased PVC duct lines shall be not less than 6 inches nor more than 12 inches wide, and the trench for 2 or more ducts installed at the same level shall be proportionately wider. Trench bottoms for ducts without concrete encasement shall be made to conform accurately to grade so as to provide uniform support for the duct along its entire length. PVC conduit, without concrete encasements, is permitted where installed 30" or more below grade.
- E. A layer of fine earth material, at least 4 inches thick (loose measurement) shall be placed in the bottom of the trench as bedding for the duct. The bedding material shall consist of soft dirt, sand or other fine fill, and it shall contain no particles that would be retained on a 1/4-inch sieve. The bedding material shall be tamped until firm.
- F. When two or more ducts are installed in the same trench without concrete encasement, they shall be spaced not less than 2 inches apart (measured from outside wall to outside wall) in a horizontal direction and not less than 6 inches apart in a vertical direction. Separators shall be placed 5'-0" on centers, and shall be saddle type, non-corrosive, specifically manufactured for the purpose.
- G. Trenches shall be opened the complete length before duct is installed so that if any obstructions are encountered, proper provisions can be made to avoid them.
- H. Trenches shall not be excessively wet and shall not contain pools of water during backfilling operations. The electrical Contractor is responsible for all draining and pumping of his excavation.

- I. The trench shall be completely backfilled and tamped level with the adjacent surface, except that, when sod or topsoil is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, or topsoil layer, with proper allowance for settlement.
- J. For ducts without concrete envelope, 8 inches of sand, soft earth, or other fine fill (Loose measurement) shall be placed around the ducts and carefully tamped around and over them with hand tampers. The remaining trench may be filled with regular run of excavated material and thoroughly tamped to original densities without the use of heavy grading equipment.
- K. Where sod has been removed, it shall be replaced as soon as possible. All areas disturbed by the trenching, storing of dirt, cable laying, pad construction and other work shall be restored to its original condition. The restoration shall include any necessary topsoiling, fertilizing, liming, seeding, or mulching. The Contractor shall be held responsible for maintaining all disturbed surface and replacements until final acceptance. Excess excavated material shall be disposed of, on site as directed by the Owner.
- L. Where trenches cross over existing paved or other finished areas, disturbed or damaged existing surfaces shall be restored to their original condition with new pavement or other finish of equivalent characteristics and thickness as the existing surfaces. In general however, the affected surfaces are in an area that will be replaced by new construction under other sections of these specifications.

4.4 CONDUIT AND RACEWAY SYSTEMS - GENERAL

- A. Furnish and install all conduits and other raceways, fittings, boxes, and other component parts of the conduit systems indicated on the drawing, herein specified or required for the completion and proper operation of the systems specified or indicated.
- B. All alterations, additions, removals, replacements, etc., of conduits and other related equipment of the conduit systems shall be made by this Contractor in accordance with the drawings and the specifications.
- C. Where this Contractor selects and installs an item of equipment which requires either additional conduit, boxes, fittings, etc., or a modification of the conduit system indicated on the drawings, such additional modifications shall be performed by this Contractor as part of this Contract without extra compensation. All modifications to conduit systems must be authorized before installation.
- D. This Contractor shall at all times coordinate his work with that of the all other trades so that the completed installation will present a finished appearance.
- E. Rigid Conduits: All rigid conduits shall be standard weight, galvanized pipe, circular in cross section, of diameter indicated on the drawings, and shall be evenly cut, well reamed and free from burrs or other obstructions. Conduits shall be in standard lengths with maker's name or brand and the nominal diameter stamped on each length.
- F. Underground Conduits: Conduits for Light and Power Service and Telephone Service shall be standard wall hot dip galvanized pipe conforming to current ASTM standards pipe and shall be galvanized inside and outside and/or with 40 mil PVC jacket, and heavy wall PVC with elbows and risers and exposed portions of steel as above.
- G. Conduit meeting the above specification and bearing the name or brand of Pittsburgh Standard, Republic Steel Co., Triangle, or other authorized name or brand will be acceptable. Where Contractor elects to utilize plastic conduit, except telephone work, provide ground conductors #10 minimum connected to metal box or panel ground bus to all metal boxes and to device supplied by

the run. For supply conductors above #8 AWG, capacity of ground shall be 1/3 minimum of the supply conductor rating.

- H. Conduits for Exterior Work: Exposed conduits on the exterior and wet locations, etc., shall be hot dipped galvanized steel conduits meeting the requirements of paragraph above.
- I. Conduit Sizes: The sizes of conduits indicated on the drawings are the minimum acceptable. Where drawings do not indicate a size, conduits shall be not less than 2" size (normal diameter) or of such larger size as required by the National Electric Code for the number of conductors specified or indicated on the drawings.
- J. Couplings and Elbows:
 - 1. Field conduit bends shall be made without kinking or reducing the internal diameter. All bends of 1-1/2" conduit size or larger shall be made with a power pipe bender, or a manufactured "L" shall be used. PVC conduit shall utilize pre-manufactured elbows only.
 - 2. Where it is impossible to turn steel conduit in coupling sections together, an authorized "Erickson" type threaded coupling, the equal of "Universal", Tomas and Betts 600 series, or GESP 600 series shall be used to make up the joints. "Running threads" or any excessive lengths of threading on conduits at couplings or boxes will not be permitted.
 - 3. Split coupling O.Z. Type "SSP" with neoprene gasket may be used as an alternate. Conduit connections at cabinets shall be made in a neat and workmanlike manner to the satisfaction of the Owner.
- K. Bushings:
 - 1. Insulated: All conduits having a nominal diameter of one inch or larger shall be equipped with insulated bushings.
 - 2. Grounding: All conduits for feeder work that do not include separate ground wires shall have grounding bushings.
- L. Preparation of Conduits for Installation. The ends of conduits shall be cut square and reamed after cutting. Connections at couplings and box fittings shall be made up tight. Conduit threads, after coupling shall be painted with zinc chromate when conduit is placed in a poured fill or slab, poured concrete, in contact with earth, or exposed to the elements of weather.
- M. PVC joints shall be fully inserted with adhesive applied inside and out. Adhesive to be as recommended by conduit manufacturer.
- N. Connections to Boxes: Wherever conduits are connected to boxes and to other electrical equipment, a single locknut shall be employed on the outside of the box, or equipment and a bushing and a locknut on the inside of the box. Locknuts and bushings shall be of galvanized steel: die cast aluminum bushings and locknuts are not acceptable.
- O. Concrete Envelopes: Provide concrete enclosures for all underground steel conduit as follows:
 - 1. Concrete envelopes shall meet the following specification: There shall be a minimum of two inches of concrete on all sides of the conduit. Concrete shall be 1:5-1/2 mix average concrete. Conduits shall pitch away from building.
 - 2. Concrete enclosure shall not be poured until permission is given by the Owner's representative. Trench shall not be filled in until permission to fill has been given by the Owner's representative after inspection.
 - 3. A 6" clearance must be allowed (to 5'-0" from building line), on conduits terminated for sitework at 5'-6" to permit makeup of joint under this Contract. All steel underground conduit joints are to be encased.

4. PVC conduits require no envelope unless indicated; however, the Contractor shall grout building conduit steel terminations to 2-2/2" beyond transition to plastic conduit. Provide all required transitions.
- P. Location of Outlets: Locations of outlets, etc., are indicated on the drawings and specified. The right is reserved to change the location of any outlet before same is permanently installed. Such changes shall be at the option of The Owner and shall be done without extra charge by the Contractor.
- Q. Conduit Ends: During installation, all unfinished runs of conduits and conduit shall be provided with T. & B., Appleton, N.E.P. Co. or other equal capped bushings. Conduits at cabinets shall remain capped until building is ready for the installation of conductors.
- R. Pull or Junction Boxes:
 1. Pull or junction boxes shall be installed at locations indicated on the drawings and wherever required for convenience of installation of conductors. Location of boxes shall be subject to Architect's approval.
 2. All boxes shall be flush in grade or concrete, installed in an authorized manner.
 3. Hardware in roadway shall be Flockhart Foundry, Campbell or authorized equal.
 4. Boxes shall be precast concrete handholes of construction suited to load and burial depth, having cast iron cover at grade in paving or cast concrete cover with marker stanchion in turf. Such boxes shall have conduits turned up into bottom of box to maintain burial depth. Traffic areas shall all have roadway covers and precast concrete construction to suit roadway classification.
 5. Precast boxes shall include reinforcing and wall dimensions for service to which applied, Elm-Cap or equal. Submit shop drawings of all boxes for approval.

4.5 CONDUCTORS:

- A. Install copper conductors indicated on the drawings, herein specified, or required by code and for the proper operation of the various systems. All connections shall be made complete, and all systems shall be energized and in proper operating condition 4 weeks before the date set for opening of the building.
- B. In certain electrical systems, the equipment furnished by one authorized manufacturer may require different wiring than the equipment furnished by another manufacturer. The drawings indicate the wiring required for the installation and proper operation of one of the systems specified. If Owner chooses to install an authorized system requiring different wiring, any additional material or labor required to perform the wiring of the new system shall be furnished by this Contractor as part of this contract without extra cost.
- C. All conductors shall be copper of 98% conductivity, stranded, free from defects, and except as otherwise specified, shall be type THHN insulated. All conductors shall meet the requirements of the Underwriters' Laboratories, IPCEA and the National Electrical Code.
- D. Splices:
 1. The conductivity and physical strength of splices shall be equal to that of the unspliced conductor.
 2. Splices shall be covered by the number of half lapped servings of rubber tape which are sufficient to produce an insulation resistance equal to or greater than the insulation resistance of the insulated conductor. Over the rubber tape, plastic tape shall be applied.
 3. Splices shall be made with mechanical splices using pressure tool (with pressure connectors, insulators and locking rings), such as Buchanan splice caps Cat. No. 2007 and No. 2014

nylon insulators are authorized for operating temperature to 105° C and for use in ballasted fixtures.

4. Mechanical splices of Dycap Catalog No. 1218 using a pressure tool, Dycap No. SCC12, will be acceptable for branch circuit and fixture wiring connections only.
5. Mechanical splices, made with insulated connectors not requiring a pressure tool as manufactured by Minnesota Mining and Manufacturing Company, "Scotchlok", and Ideal "Wing-Nut" or Super-Nut" pressure types will also be acceptable for splicing of branch circuit conductors only.
6. All splices in inground boxes or devices shall be sealed watertight with epoxy molded casing as manufactured by 3M, "Scotchcast" or heat shrink sleeves.

E. Tapes:

1. Rubber tape: Rubber tape shall comply with the latest specifications of the ASTM and shall be so marked on each box. Tape shall be 3/4" wide, 0.030" thick.
2. Plastic Tape: Plastic tape shall be 3/4" wide, 0.007" thick, the authorized equal of Minnesota Mining and Manufacturing Co., "Scotch" No. 33 electrical tape.
3. Authorized tapes: Tapes meeting the above specifications as made by Paranite, E.E., Plymouth, U.S. Rubber, Clifton, Okonite, Manson, or equal will be authorized.

F. Feeders:

1. All feeder conductors that are installed in conduits buried in the earth, or in concrete slabs contiguous to the earth, or outside the building shall be Underwriters approved type USE with neoprene sheath.
2. Secondary service conductors complete to utility transformer regardless of 5 ft. general rules, will be furnished under Division 16.

G. Branch Circuits:

1. Coordinate carefully with Contractor for interior work to insure that power is locked "off", and so secured when performing circuit work.
2. Branch circuits shall consist of single conductors of size No. 8 unless otherwise indicated on drawings or specifications. The number of conductors in each conduit shall be per code for supply and control on the drawings or in the specifications.
3. Circuit conductors shall be connected at the panelboards so that numbers adjacent to "home runs" on the drawings correspond to numbered buttons on switches or circuit breakers. Modification may be made to obtain phase balance of loads. Coordinate work with Contractor for interior work.

- H. At each splice, pole base, termination and box, provide "Brady", "Seton" or T & B, markers on each conductor coinciding with panel circuit information.

END OF SECTION - 16000

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior luminaires with lamps and ballasts and relays.
 - 2. Poles and accessories.
- B. Related Sections:
 - 1. Refer to electrical plans and specifications

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT - NOT USED

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color-rendering index.
- C. HID: High-intensity discharge.
- D. LER: Luminaire efficacy rating.
- E. Luminaire: Complete lighting fixture, including ballast housing if provided.
- F. Pole: Luminaire support structure, including tower used for large area illumination.
- G. Standard: Same definition as "Pole" above.

1.4 PERFORMANCE REQUIREMENTS

- A. Foundations – Meet all manufacturer’s specifications, Township of Cranbury and NJDOT Standards.
- B. Standards / fixtures – Meet all manufacturer’s specifications, Township of Cranbury and NJDOT Standards.
- C. Lamps - Install LED lamps in all new lighting fixtures. Submit illumination and color specifications to Engineer for review before ordering an installation.
- D. Electrical – Meet all standards and code requirements as per electrical specifications

1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

- B. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
 2. Details of attaching luminaires and accessories.
 3. Details of installation and construction.
 4. Luminaire materials.
 5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
 - a. Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
 - b. Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
 6. Photoelectric relays.
 7. Ballasts, including energy-efficiency data.
 8. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
 9. Materials, dimensions, and finishes of poles.
 10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
 11. Anchor bolts for poles.
 12. Manufactured pole foundations.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
 3. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
 4. Wiring Diagrams: For power, signal, and control wiring.
- D. Samples: For products designated for sample submission in the Exterior Lighting Device Schedule. Each Sample shall include lamps and ballasts.
- E. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.
- F. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.
- G. Field quality-control reports.
- H. Operation and Maintenance Data: For luminaires, poles and luminaire lowering devices to include in emergency, operation, and maintenance manuals.
- I. Warranty: Sample of special warranty.

1.6 SUSTAINABLE DESIGN SUBMITTALS

- A. Section 01 81 13 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements of Division 01.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301 and requirements of Section 03 30 00.
- B. Perform Work in accordance with 2007 NJDOT Standard Specifications and Township of Cranbury standards.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing work of this section with minimum 3 years experience.
- C. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- D. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.
- E. 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.
- F. Comply with IEEE C2, "National Electrical Safety Code."
- G. Comply with NFPA 70.

1.9 MOCKUP – NOT USED

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Package aluminum poles for shipping according to ASTM B 660.
- B. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
- C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch deep. Do not apply tools to section of pole to be installed below ground line.

- D. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.
- E. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

1.12 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
 - 1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
 - 2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
 - 3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
 - 4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

1.13 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Lamps: One for every 10 of each type and rating installed. Furnish at least one of each type.
 - 2. Glass and Plastic Lenses, Covers, and Other Optical Parts: One for every 10 of each type and rating installed. Furnish at least one of each type.
 - 3. Ballasts: One for every 10 of each type and rating installed. Furnish at least one of each type.
 - 4. Globes and Guards: One for every 5 of each type and rating installed. Furnish at least one of each type.

PART 2 PRODUCTS

2.1 PARKING LOT LUMINAIRE – “Glaswerks’ LED BERN

- A. Manufacturer: Holophane, 3825 Columbus Rd, Granville, Ohio 43023, P: 866-759-1577, F: 866-637-7069
 - 1. Model #: Refer to Construction Documents
 - a. Finish: Refer to Construction Documents
 - b. Mounting: Refer to Construction Documents
- B. Refer to landscape and light plans and detail sheet for detailed specifications.

2.2 WALKWAY BOLLARDS – Antique Street Lamps – TLRC 10 – LED Bollard

- A. Refer to landscape and lighting plan and detail sheet for detailed specification.
- B. Manufacturer: Antique Street Lamps, 1170 Peachtree Street NE, Suite 2300, Atlanta, GA 30309-7676; 1-800-922-9642
 - 1. Model #: Refer to Construction Documents
 - a. Finish: Refer to Construction Documents
 - b. Mounting: Refer to Construction Documents

PART 3 EXECUTION

3.1 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire – for new fixtures.
- B. Fasten luminaire to indicated structural supports.
 - 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Adjust luminaires that require field adjustment or aiming with Engineer. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.2 POLE INSTALLATION

- A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features, unless otherwise indicated on Drawings. Review final locations in field with Engineer prior to installation:
 - 1. Fire Hydrants and Storm Drainage Piping: 60 inches.
 - 2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet.
 - 3. Trees: 5 feet from tree trunk.
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete." Set top of concrete light foundations flush with adjacent curb and/or sidewalk.
- D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
 - 1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
 - 2. Grout void between pole base and foundation. Use non-shrink or expanding concrete grout firmly packed to fill space. Maximum grout joint not to exceed 1 inch.
 - 3. Install base covers unless otherwise indicated.

4. Use a short piece of 1/2-inch- (13-mm-) diameter PVC pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- E. Raise and set poles using web fabric slings (not chain or cable).
- F. Touch up areas where paint has been marred by transport or installation using paint specified by manufacturer. Apply to blend with existing paint surface.

3.3 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal products or fasteners, protect aluminum by adequately insulating fittings or treatment from galvanic reactions.
- B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 GROUNDING

- A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 1. Install grounding electrode for each pole unless otherwise indicated.
 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
- B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 1. Install grounding electrode for each pole.
 2. Install grounding conductor and conductor protector.
 3. Ground metallic components of pole accessories and foundations.

3.5 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
 1. Verify operation of photoelectric controls.
- C. Illumination Tests:
 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):
 - a. IESNA LM-5, "Photometric Measurements of Area and Sports Lighting Installations."
 - b. IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
 - c. IESNA LM-52, "Photometric Measurements of Roadway Sign Installations."
 - d. IESNA LM-64, "Photometric Measurements of Parking Areas."
 - e. IESNA LM-72, "Directional Positioning of Photometric Data."

- D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices.

END OF SECTION

SECTION 31 05 13

SOILS FOR EARTHWORK

PART 1 GENERAL

1.1 STIPULATIONS

- A. The specifications sections “General Conditions of Contract”, “Special Conditions” and “Division 1 – General Requirements” form a part of this section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.2 SUMMARY

A. Section Includes:

1. Subsoil materials.
2. Topsoil materials.

B. Related Sections:

1. Section 31 05 16 - Aggregates for Earthwork.
2. Section 31 22 13 - Rough Grading.
3. Section 31 23 17 - Trenching.
4. Section 31 23 23 - Fill.
5. Section 32 05 13 - Soils for Exterior Improvements.
6. Section 32 05 16 - Aggregates for Exterior Improvements.
7. Section 32 91 19 - Landscape Grading.
8. Section 32 92 19 - Seeding and Soil Supplements.
9. Section 32 93 00 - Plants.
10. Division 01 Section “Construction Waste Management”
11. Division 01 Section “Sustainable Design Requirements”

1.3 UNIT PRICES - MEASUREMENT AND PAYMENT- NOT USED

1.4 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

C. 2007 NJDOT Standard Specifications

1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Materials Source: Submit name of imported materials source and provide a “clean fill” certification.
- C. Manufacturer's Certificate: Certify Structural Fill meets or exceeds gradation envelope.

1.6 SUSTAINABLE DESIGN SUBMITTALS

- A. Section 01 81 13 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements of Division 01.

1.7 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.
- B. Perform Work in accordance with NJDOT Standards and Township of Cranbury standards.
- C. Furnish each subsoil and topsoil material from single source throughout the Work.
- D. Perform Work in accordance with New Jersey Department of Transportation (NJDOT) Standard Specifications for Road and Bridge Construction, latest edition with amendments. The specifications will herein be referred to as NJDOT’s standards in subsequent paragraphs in this document.

PART 2 PRODUCTS

2.1 SUBSOIL MATERIALS

- A. General Fill shall conform with Section 206 Embankment of NJDOT Standard Specifications
- B. General Fill Material shall be of a maximum size that can readily be placed in loose 8-inch layers.
 - 1. Gradation – More than 35% passing No. 200 sieve
 - 2. Minimum dry mass density – 95 lbs per cubic feet determined according to PTM No. 106, Method B.
 - 3. Maximum liquid limit -65, determined according to AASHTO 89
 - 4. Plasticity Index – Not less than liquid limit minus 30, determined according to AASHTO T90 for soils with liquid limits of 41 to 65.

2.2 STRUCTURAL FILL MATERIALS

- A. Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand with at least 90 percent passing a 1-1/2-inch sieve and not more than 20 percent passing a No. 200 sieve and with a plasticity index not greater than 8 percent. Recycled concrete is considered suitable for use as engineered fill even though the percent passing the No. 200 sieve may be greater than 20 percent. Imported fill material shall be approved by Geotechnical Engineer well in advance of fill construction.
- B. Structural fill shall be compacted to at least 98 percent of the laboratory determined dry density for footings and 95 percent of the laboratory determined dry density for slab on grade.

2.3 TOPSOIL MATERIALS

- A. Topsoil: Conforming to NJDOT Standard Specifications

2.4 GRANULAR FILL

- A. AASHTO Size #57 stone in accordance with the gradation set forth in NJDOT Standard Specifications

2.5 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Testing and Inspection Services, Testing and analysis of soil material.
- B. Testing and Analysis of Subsoil Material: Perform in accordance with AASHTO T180.
- C. Testing and Analysis of Topsoil Material: Perform in accordance with AASHTO T180.
- D. When tests indicate materials do not meet specified requirements, change material and retest.
- E. Furnish materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT

- A. The contractor, subcontractors, and their personnel shall follow the procedures and practices for waste separation, collection and transport as defined in the contractor's "Waste Management Plan" as required by Division 01 Section "Construction Waste Management."

3.2 EXCAVATION

- A. Excavate subsoil and topsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas.

- B. Stockpile excavated material meeting requirements for subsoil materials and topsoil materials.
- C. Remove excess excavated materials, subsoil and topsoil not intended for reuse, from site.
- D. Remove excavated materials not meeting requirements for subsoil material and topsoil materials from site.

3.3 STOCKPILING

- A. Stockpile materials on site at locations indicated by Engineer.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Prevent intermixing of soil types or contamination.
- E. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
- F. Stockpile unsuitable materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.4 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 31 05 16

AGGREGATES FOR EARTHWORK

PART 1 GENERAL

1.1 STIPULATIONS

- A. The specifications sections “General Conditions of Contract”, “Special Conditions” and “Division 1 – General Requirements” form a part of this section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.2 SUMMARY

- A. Section Includes:
 - 1. Coarse aggregate materials.
 - 2. Fine aggregate materials.
- B. Related Sections:
 - 1. Section 31 05 13 - Soils for Earthwork: Fill and grading materials.
 - 2. Section 31 22 13 - Rough Grading.
 - 3. Section 31 23 17 - Trenching.
 - 4. Section 31 23 23 - Fill.
 - 5. Section 32 05 13 - Soils for Exterior Improvements.
 - 6. Section 32 05 16 - Aggregates for Exterior Improvements
 - 7. Section 32 91 19 - Landscape Grading.
 - 8. Section 33 11 16 - Site Water Utility Distribution Piping.
 - 9. Section 33 31 00 - Sanitary Utility Sewerage Piping.
 - 10. Section 33 41 00 - Storm Utility Drainage Piping.
 - 11. Geotechnical Engineering Reports, dated July 22, 2016 and January 17, 2017, prepared by Maser Consulting, is available for this project. This report is for informational purposes only and should not be considered part of the contract documents. The opinions expressed in this report are those of the Geotechnical Consultant and represent his interpretation of the subgrade conditions, tests, and the results of analysis which he has conducted. Should the data contained in the report not be adequate for the Contractor’s purposes, the Contractor may make, prior to bidding, his own investigation, tests, and analysis.
 - 12. Division 01 Section “Construction Waste Management”
 - 13. Division 01 Section “Sustainable Design Requirements”

1.3 UNIT PRICE - MEASUREMENT AND PAYMENT – NOT USED

1.4 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
 - 2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
5. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

C. NJDOT Standard Specifications

1.5 SUBMITTALS

- A. Materials Source: Submit name of imported materials suppliers.
- B. Manufacturer's Certificate: Certify Products meet or exceed NJDOT Standard Specifications.

1.6 SUSTAINABLE DESIGN SUBMITTALS

- A. Section 01 81 13 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements of Division 01.

1.7 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.
- B. Perform Work in accordance with NJDOT Standard Specifications.

PART 2 PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

- A. Coarse Aggregate : Type C. Conforming to NJDOT Standard Specifications.

Soundness, Max %	20
Abrasion, Max %	55
Thin and Elongated Pieces, Max %	-
Material Finer than No. 200 Sieve, Max %	10
Crushed Fragments, Min %	50
Compact Density, Min (lbs/cf)	70
Deleterious Shale, Max %	10
Clay Lumps, Max %	3
Friable Particles, Max % (excl. shale)	-
Coal or Coke, Max %	5
Glassy Particles, Max %	-
Iron, Max %	3
Absorbtion, Max %	-
Total of Deleterious Shale, Clay Lumps, Friable Particles, Coal or Coke Allowed, Max %	15

2.2 FINE AGGREGATE MATERIALS

A. Fine Aggregate : Conforming to NJDOT Standard Specifications

GRADING AND QUALITY REQUIREMENTS – FINE AGGREGATES

Sieve Size	Cement Concrete Sand	Bituminous Concrete Sand Type B				Mortar Sand
	Type A	#1	#2	#3	Filler	Type C
3/8"	100	100	-	100	-	-
No. 4	95-100	95-100	100	80-100	-	100
No. 8	70-100	70-100	95-100	65-100	-	95-100
No. 16	45-85	40-80	85-100	40-80	-	-
No. 30	25-65	20-65	65-90	20-65	100	-
No. 50	10-30	7-40	30-60	7-40	95-100	-
No. 100	0-10	2-20	5-25	2-20	90-100	-
No. 200	-	0-10	0-5	0-10	70-100	0-10
Finer than 200	3	-	-	-	-	-
Strength Ratio Min %	95	-	-	-	-	95
Soundness Test, Max Loss %	10	-	-	-	-	10
Fineness Modulus	2.30-3.15	-	-	-	-	1.6-2.5

2.3 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements . Testing and inspection services.

B. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698. ASTM D1557.AASHTO T180.ASTM D4318.ASTM C136; NJDOT Standard Specifications

- C. Fine Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D698. ASTM D1557.AASHTO T180.ASTM D4318.ASTM C136; NJDOT Standard Specifications.
- D. When tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT

- A. The contractor, subcontractors, and their personnel shall follow the procedures and practices for waste separation, collection and transport as defined in the contractor's "Waste Management Plan" as required by Division 01 Section "Construction Waste Management."

3.2 EXCAVATION

- A. Remove excess excavated materials, coarse aggregate materials, and fine aggregate materials not intended for reuse, from site.
- B. Remove excavated materials not meeting requirements for coarse aggregate materials, and fine aggregate materials from site.

3.3 STOCKPILING

- A. Stockpile materials on site at locations designated by Architect/Engineer.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.
- D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.4 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Section Includes:
2. Removing surface debris.
3. Removing designated paving, curbs, and sidewalks.
4. Removing designated trees, shrubs, and other plant life.
5. Removing abandoned utilities.
6. Excavating topsoil.
7. Removing abandoned utilities.

B. Related Sections:

1. Section 31 22 13 - Rough Grading.
2. Division 01 Section "Construction Waste Management"
3. Division 01 Section "Sustainable Design Requirements"

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT- NOT USED

1.3 SUSTAINABLE DESIGN SUBMITTALS

A. Section 01 81 13 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.

1. Materials Resources Certificates:

- a. Certify source for local and regional materials and distance from Project site.

C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.

1. Provide cost data for the following products:

- a. Local and regional products.

1.4 SUSTAINABLE DESIGN SUBMITTALS

A. Section 01 81 13 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements of Division 01.

1.5 QUALITY ASSURANCE

- A. Conform to applicable NJDEP and Township code for environmental requirements
- B. Sustainable Design Requirements:
 - 1. Separate recyclable material and document quantity.
 - 2. Recyclable material includes but is not limited to: vegetative waste, asphalt, and concrete in accordance with the waste management plan.

PART 2 EXECUTION

2.1 CONSTRUCTION WASTE MANAGEMENT

- A. The contractor, subcontractors, and their personnel shall follow the procedures and practices for waste separation, collection and transport as defined in the contractor's "Waste Management Plan" as required by Division 01 Section "Construction Waste Management.

2.2 EXAMINATION

- A. Verify existing plant life designated to remain is tagged or identified.
- B. Identify waste area for placing removed materials.

2.3 PREPARATION

- A. Call NJ One Call not less than three working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.

2.4 PROTECTION

- A. Locate, identify, and protect utilities indicated to remain, from damage.
- B. Protect trees, plant growth, and features designated to remain, as final landscaping
- C. Protect bench marks, survey control points, and existing structures from damage or displacement.

2.5 CLEARING

- A. Clear areas required for access to site and execution of Work to minimum depth to achieve required grades.
- B. Remove trees and shrubs indicated. Remove stumps.
- C. Clear undergrowth and deadwood, without disturbing subsoil.

2.6 REMOVAL

- A. Remove debris, rock, and extracted plant life from site.
- B. Remove abandoned utilities. Indicated removal termination point for underground utilities on Record Documents.
- C. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.
- D. Do not burn or bury materials on site. Leave site in clean condition.

2.7 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials for use in finish grading.
- B. Do not excavate wet topsoil.
- C. Stockpile in area designated on site and protect from erosion.
- D. Remove excess topsoil not intended for reuse, from site.

END OF SECTION

SECTION 31 22 13

ROUGH GRADING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating topsoil.
2. Excavating subsoil.
3. Cutting, grading, filling, rough contouring, compacting site for site structures and building pads.

B. Related Sections:

1. Section 31 05 13 - Soils for Earthwork
2. Section 31 05 16 - Aggregates for Earthwork
3. Section 31 10 00 - Site Clearing
4. Section 31 23 16 - Excavation
5. Section 31 23 17 - Trenching
6. Section 31 23 23 - Fill
7. Section 32 91 19 - Landscape Grading
8. Division 01 Section "Construction Waste Management"
9. Division 01 Section "Sustainable Design Requirements"

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT – NOT USED

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
3. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
5. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
6. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
7. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).
8. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

9. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

C. NJDOT Standard Specifications

1.4 SUBMITTALS – NOT USED

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements : Requirements for submittals.

B. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.6 SUSTAINABLE DESIGN SUBMITTALS

A. Section 01 81 13 - Sustainable Design Requirements: Requirements for sustainable design submittals.

B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements of Division 01.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with NJDOT Standard Specifications

B. Perform Work in accordance with Section 31 23 16

PART 2 PRODUCTS

2.1 MATERIALS- NOT USED

A. Topsoil: As specified in Section 31 05 13.

B. Subsoil Fill: As specified in Section 31 05 13.

C. Structural Fill: Type S1, Lightweight Fill, Dense Graded aggregates, recycled concrete aggregates as specified in Section 31 05 13.

D. Granular Fill: Type A1, Type 'G' Fills, Lightweight Fill, Dense Graded aggregates, recycled concrete aggregates as specified in Section 31 05 16.

PART 3 EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT

- A. The contractor, subcontractors, and their personnel shall follow the procedures and practices for waste separation, collection and transport as defined in the contractor's "Waste Management Plan" as required by Division 01 Section "Construction Waste Management."

3.2 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements : Verification of existing conditions before starting work.
- B. Verify site conditions
- C. Verify survey bench mark and intended elevations for the Work are as indicated on Drawings.

3.3 PREPARATION

- A. Call Local Utility Line Information service at 1-800-242-1776 not less than three working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours, and datum.
- C. Notify utility company to remove and relocate utilities.
- D. Protect utilities indicated to remain from damage.
- E. Protect plant life, lawns, rock outcropping and other features remaining as portion of final landscaping.
- F. Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.4 SUBSOIL EXCAVATION

- A. Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded.
- B. Excavate and process wet material to obtain optimum moisture content.
- C. When excavating through roots, perform Work by hand and cut roots with sharp axe.
- D. Remove excess subsoil not intended for reuse, from site.
- E. Benching Slopes: Horizontally bench existing slopes greater than 1: 4 to key placed fill material to slope to provide firm bearing.

F. Stability: Replace damaged or displaced subsoil as specified for fill.

3.5 FILLING

A. Fill areas to contours and elevations with unfrozen materials.

B. Place fill material in continuous layers and compact in accordance with NJDOT Standard Specifications

C. Maintain optimum moisture content of fill materials to attain required compaction density.

D. Slope grade away from building minimum 2 percent slope for minimum distance of 10 ft unless noted otherwise.

E. Make grade changes gradual. Blend slope into level areas.

F. Repair or replace items indicated to remain damaged by excavation or filling.

3.6 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Top Surface of Subgrade: Plus or minus 1/10 foot from required elevation.

END OF SECTION

SECTION 31 23 16

EXCAVATION

PART 1 GENERAL

1.1 STIPULATIONS

- A. The specifications sections “General Conditions of Contract”, “Special Conditions” and “Division 1 – General Requirements” form a part of this section by this reference thereto, and shall have the same force and effect as if printed herewith in full.
- B. Excavation for this Project shall be considered unclassified and shall include all types of earth and soil, any pebbles, boulders, and bedrock, municipal trash, rubbish and garbage and all types of debris of the construction industry such as wood, stone, concrete, plaster, brick, mortar, steel and iron shapes, pipe, wire, asphaltic materials, paper and glass. Unclassified excavation does not include unforeseen concrete foundations, walls, or slabs. All such materials encountered which are identified by this paragraph as unclassified shall be removed to the required widths and depths to create a finished product as shown and/or noted on the drawings and as written in the specifications. No additional compensation shall be made to the contractor for this unclassified excavation. The materials defined by this paragraph as unclassified will not be considered to be concealed conditions or unknown physical conditions below the surface of the ground for purposes of interpreting the language in the General Conditions of the Construction Contract.
- C. Any available data concerning subsurface materials or conditions based on soundings, test pits or test borings, has been obtained by the Township for its own use in designing this Project. The Test Boring logs contained within the Geotechnical Report are not incorporated into the construction contract as a Contract Document. The remainder of the Geotechnical Report, with all other exhibits, is available for informational/guidance purposes only; it is not to be relied on by prospective Bidders. The Report is available to Bidders at the office of the Professional upon signature of a standard form of receipt, whereby the bidder acknowledges and understands that the information and recommendations in the Report is not warranted for accuracy, correctness or completeness, and is not incorporated into the construction contract as a Contract Document.

Test Boring logs reflect the conditions at the specific locations of each Test Boring only. The Contractor accepts full responsibility for any conclusions drawn with respect to conditions between Test Borings. Bidders shall therefore undertake to perform their own investigation of existing subsurface conditions. The Department will not be responsible in any way for the consequences of the Contractor’s failure to conduct such investigation. Excavation for the Project is considered “unclassified”, as fully described below.

1.2 SUMMARY

- A. Section Includes:
 - 1. Excavating for building foundations.
 - 2. Excavating for paving, roads, and parking areas.
 - 3. Excavating for slabs-on-grade.
 - 4. Excavating for site structures.

5. Excavating for landscaping.

B. Related Sections:

1. Section 31 05 13 - Soils for Earthwork: Stockpiling excavated materials.
2. Section 31 05 16 - Aggregates for Earthwork: Stockpiling excavated materials.
3. Section 31 22 13 - Rough Grading: Topsoil and subsoil removal from site surface.
4. Section 31 23 17 - Trenching: Excavating for utility trenches.
5. Section 31 23 18 - Rock Removal: Removal of rock during excavating.
6. Section 31 23 23 - Fill.
7. Section 33 11 16 - Site Water Utility Distribution Piping.
8. Geotechnical Engineering Reports, dated July 22, 2016 and January 17, 2017, prepared by Maser Consulting, is available for this project. This report is for informational purposes only and should not be considered part of the contract documents. The opinions expressed in this report are those of the Geotechnical Consultant and represent his interpretation of the subgrade conditions, tests, and the results of analysis which he has conducted. Should the data contained in the report not be adequate for the Contractor's purposes, the Contractor may make, prior to bidding, his own investigation, tests, and analysis.
9. Division 01 Section "Construction Waste Management"
10. Division 01 Section "Sustainable Design Requirements"

1.3 UNIT PRICE - MEASUREMENT AND PAYMENT – NOT USED

1.4 REFERENCES

- A. Local utility standards when working within 24 inches of utility lines.
- B. NJDOT Standard Specifications

1.5 SUSTAINABLE DESIGN SUBMITTALS

- A. Section 01 81 13 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements of Division 01.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with NJDOT Standard Specifications
- B. The Owner shall provide and pay for the services of a Geotechnical Consultant who will have the responsibility of determining what subgrade is acceptable or unacceptable and must be removed by the Contractor. The fill and or structural soil fill or select structural fill shall be installed and compacted under the direction and observation of the Geotechnical Consultant.
- C. Pre-Excavation photographs or videotape: Show existing conditions of adjoining construction and site improvements, including furnish surfaces that might be misconstrued as damage caused by earthwork operations.

1.7 QUALIFICATIONS – NOT USED

PART 2 PRODUCTS- NOT USED

PART 3 EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT

- A. The contractor, subcontractors, and their personnel shall follow the procedures and practices for waste separation, collection and transport as defined in the contractor's "Waste Management Plan" as required by Division 01 Section "Construction Waste Management."

3.2 PREPARATION

- A. Call the one-call number at 811 not less than three working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours, and datum.
- C. Notify utility company to remove and relocate utilities.
- D. Protect utilities indicated to remain from damage.
- E. Protect plant life, lawns, rock outcroppings and other features remaining as portion of final landscaping.
- F. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 EXCAVATION

- A. Excavate subsoil to accommodate building foundations, slabs-on-grade, paving and site structures and construction operations to the required depth as shown on the plans.
- B. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Section 31 23 23 and Section 31 23 17.
- C. Slope banks with machine to angle of repose or less until shored.
- D. Do not interfere with 45 degree bearing splay of foundations.
- E. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- F. Trim excavation. Remove loose matter.
- G. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume. Remove larger material as specified in Section 31 23 23.

- H. Notify Architect/Engineer of unexpected subsurface conditions.
- I. Correct areas over excavated with structural fill as directed by Geotechnical Engineer.
- J. Remove excess and unsuitable material from site.
- K. Stockpile excavated material in area designated on site in accordance with Section 31 05 13 .
- L. Repair or replace items indicated to remain damaged by excavation.

3.4 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Approval of Bearing Strata
 - 1. The Contractor shall furnish adequate advance notification to the Architect/Engineer of times when footing excavations are to be completed, so that the bearing quality of bottoms may be inspected and/or tested and approved. Formwork and concreting shall follow only after this approval.
 - 2. Should the bearing at the levels indicated be found by the Architect/Engineer and the Department to be inadequate, they may order the excavation carried down to sound bearing. Such excavation shall be classed as additional work and payment be made on the basis of an agreed price according to the General Conditions. Should suitable bearing be found at a lesser depth than indicated, the Architect/Engineer and the Department may order the reduction of excavation specified or shown on the drawings, and the Contractor shall allow a credit for excavation thus omitted on the same basis.
 - 3. Request inspection of excavation and controlled fill operations in accordance with applicable code.
- C. Quality Control Testing
 - 1. Quality Control tests shall include tests on fill material, optimum moisture content and maximum density and field density tests of fill layers. The QC Testing agent shall comment on the suitability of all subgrades, and the subgrades shall be acceptable to the QA Agency.
 - 2. Handwritten copies of field test reports shall be provided to the Contractor. They shall be given to the Contractor and inspector within two (2) hours of completion, but in no event shall the technician leave the site without providing the Contractor and inspector with a copy of the test results. This shall include density, % moisture, plan location, elevation, comments and any other relevant data. Comments shall include any condition that might have an adverse affect on the operations, including weather, drainage, etc.
 - 3. The Contractor shall request consultation with the Consulting Geotechnical Engineer on any problems that arise during construction. Copies of the daily in-place soil density tests shall be faxed to the consultant by the Contractor through the testing agency within twenty-four (24) hours of the time the tests are made.
 - 4. The Geotechnical Consultant shall approve each subgrade and each fill layer before proceeding to the next layer. Any area which does not meet density, % moisture or other requirements at any time, shall be suitably reworked and retested by the Contractor at his own expense.
 - 5. The Owner will perform Quality Assurance tests in accordance with Section 01 40 00 deemed necessary for the assurance of the Professional and/or the Department. This does

not relieve the Contractor of his responsibilities. The Owner will bear the cost of Quality Assurance tests.

3.5 PROTECTION

- A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION

SECTION 31 23 17

TRENCHING

PART 1 GENERAL

1.1 STIPULATIONS

- A. The specifications sections “General Conditions of Contract”, “Special Conditions” and “Division 1 – General Requirements” form a part of this section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.2 SUMMARY

A. Section Includes:

1. Excavating trenches for utilities from 5 feet outside building to utility service.
2. Compacted fill from top of utility bedding to subgrade elevations.
3. Backfilling and compaction.

B. Related Sections:

1. Section 31 05 13 - Soils for Earthwork: Soils for fill.
2. Section 31 05 16 - Aggregates for Earthwork: Aggregates for fill.
3. Section 31 22 13 - Rough Grading: Topsoil and subsoil removal from site surface.
4. Section 31 23 16 - Excavation: General building excavation.
5. Section 31 23 23 - Fill: General backfilling.
6. Section 33 11 16 - Site Water Utility Distribution Piping: Water piping and bedding from building to utility service.
7. Section 33 31 00 - Sanitary Utility Sewerage Piping: Sanitary sewer piping and bedding from building to utility service.
8. Section 33 41 00 - Storm Utility Drainage Piping: Storm sewer piping and bedding from building to utility service.
9. Geotechnical Engineering Reports, dated July 27, 2016 and January 17, 2017, prepared by Maser Consulting, is available for this project. This report is for informational purposes only and should not be considered part of the contract documents. The opinions expressed in this report are those of the Geotechnical Consultant and represent his interpretation of the subgrade conditions, tests, and the results of analysis which he has conducted. Should the data contained in the report not be adequate for the Contractor’s purposes, the Contractor may make, prior to bidding, his own investigation, tests, and analysis.
10. Division 01 Section “Construction Waste Management”
11. Division 01 Section “Sustainable Design Requirement”

1.3 UNIT PRICE - MEASUREMENT AND PAYMENT – NOT USED

1.4 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

- B. ASTM International:
 - 1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 - 3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 - 5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

C. NJDOT Standard Specifications

1.5 DEFINITIONS

- A. Utility: Any buried pipe, duct, conduit, or cable.

1.6 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures : Requirements for submittals.
- B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

1.7 SUSTAINABLE DESIGN SUBMITTALS

- A. Section 01 81 13 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements of Division 01.

1.8 QUALITY ASSURANCE

- A. Perform Work in accordance with NJDOT Standard Specifications

1.9 QUALIFICATIONS

- A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of New Jersey.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.11 COORDINATION

- A. Section 01 30 00 - Administrative Requirements : Coordination and project conditions.
- B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. General Fill: As specified in Section 31 05 13
- B. Structural Fill: As specified in Section 31 05 13 and 31 05 16

PART 3 EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT

- A. The contractor, subcontractors, and their personnel shall follow the procedures and practices for waste separation, collection and transport as defined in the contractor's "Waste Management Plan" as required by Division 01 Section "Construction Waste Management."

3.2 LINES AND GRADES

- A. Lay pipes to lines and grades indicated on Drawings.
 - 1. Architect/Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.
- B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.3 PREPARATION

- A. Call the one-call number at 811 not less than three working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours, and datum locations.
- C. Protect plant life, lawns, rock outcropping and other features remaining as portion of final landscaping.
- D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Maintain and protect above and below grade utilities indicated to remain.
- F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.4 TRENCHING

- A. Excavate subsoil required for utilities to utility service.
- B. Remove lumped subsoil, boulders, and rock up of 1/3 cubic yard , measured by volume.
- C. Perform excavation within 24 inches of existing utility service in accordance with utility's requirements.
- D. Do not advance open trench more than 200 feet ahead of installed pipe.
- E. Cut trenches to width indicated on Drawings. Remove water or materials that interfere with Work.
- F. Excavate bottom of trenches maximum 2 feet wider than outside diameter of pipe.
- G. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe.
- H. Do not interfere with 45 degree bearing splay of foundations.
- I. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this section.
- J. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Geotechnical Engineer until suitable material is encountered.
- K. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Structural Fill and compact to density equal to or greater than requirements for subsequent backfill material.
- L. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.
- M. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.
- N. Remove excess subsoil not intended for reuse, from site.

3.5 SHEETING AND SHORING

- A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.
- B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.
- C. Design sheeting and shoring to be removed at completion of excavation work.
- D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

- E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.6 PROTECTION OF ADJACENT WORK

- A. Underpin adjacent structures which may be damaged by excavation work, including utilities and pipe chases.
- B. Grade excavation top perimeter to prevent surface water runoff into excavation or to adjacent properties.

3.7 MAINTENANCE AND PROTECTION OF TRAFFIC

- A. Maintenance and protection of traffic shall comply with NJDOT Standard Specifications on all public streets.
- B. Coordinate the work to insure the least inconvenience to traffic and maintain traffic in one or more unobstructed lanes unless closing the roadway is authorized.
- C. Maintain access to all streets and private drives.
- D. Maintain protective measures in accordance with the requirements of OSHA and other authorities having jurisdiction. The Contractor shall pay for all permits and inspections that are required for the installation.
- E. Provide and maintain signs, flashing warning lights, barricades, markers, and other protective devices as required to conform with construction operations and to keep traffic flowing with minimal restrictions.

3.8 BACKFILLING

- A. Backfill trenches to contours and elevations with unfrozen fill materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Place material in continuous layers as follows:
 - 1. General Fill: Maximum 8 inches compacted depth.
 - 2. Structural Fill: Maximum 6 inches compacted depth.
- D. Employ placement method that does not disturb or damage foundation perimeter drainage, utilities in trench.
- E. Install acid and alkali resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, including storm water, 6" wide, 4 mils thick, continuously inscribed with a description of the 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 as directed by authorities having jurisdiction on the project or as directed by the Architect.
- F. Maintain optimum moisture content of fill materials to attain required compaction density.

- G. Do not leave trench open at end of working day.
- H. Protect open trench to prevent danger to the public.

3.9 TOLERANCES

- A. Section 01 40 00 - Quality Requirements : Tolerances.
- B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.
- C. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.10 FIELD QUALITY CONTROL

- A. Perform all work in accordance with Section 31 23 16.

3.11 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 - Execution and Closeout Requirements : Protecting finished work.
- B. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION

SECTION 31 23 23

FILL

PART 1 GENERAL

1.1 STIPULATIONS

- A. The specifications sections “General Conditions of Contract”, “Special Conditions” and “Division 1 – General Requirements” form a part of this section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.2 SUMMARY

A. Section Includes:

1. Backfilling building perimeter to subgrade elevations.
2. Backfilling site structures to subgrade elevations.
3. Fill under slabs-on-grade.
4. Fill under paving.
5. Fill for over-excavation.

B. Related Sections:

1. Section 31 05 13 - Soils for Earthwork: Soils for fill.
2. Section 31 05 16 - Aggregates for Earthwork: Aggregates for fill.
3. Section 31 22 13 - Rough Grading:
4. Section 31 23 16 - Excavation.
5. Section 31 23 17 - Trenching: Backfilling of utility trenches.
6. Section 33 11 16 - Site Water Utility Distribution Piping.
7. Geotechnical Engineering Report, dated July 27, 2016 and January 17, 2017, prepared by Maser Consulting, is available for this project. This report is for informational purposes only and should not be considered part of the contract documents. The opinions expressed in this report are those of the Geotechnical Consultant and represent his interpretation of the subgrade conditions, tests, and the results of analysis which he has conducted. Should the data contained in the report not be adequate for the Contractor’s purposes, the Contractor may make, prior to bidding, his own investigation, tests, and analysis.
8. Division 01 Section “Construction Waste Management”
9. Division 01 Section “Sustainable Design Requirements”

1.3 UNIT PRICE - MEASUREMENT AND PAYMENT – NOT USED

1.4 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).

2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

C. NJDOT Standard Specifications

1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures : Requirements for submittals.
- B. Materials Source: Submit name of imported fill materials suppliers.
- C. Manufacturer's Certificate: Certify Products meet or exceed NJDEP requirements for residential fill.

1.6 SUSTAINABLE DESIGN SUBMITTALS

- A. Section 01 81 13 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements of Division 01.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with NJDOT Standard Specifications.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. General Fill: As specified in Section 31 05 13.
- B. Structural Fill: As specified in Section 31 05 13 . Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand with at least 90 percent passing a 1-1/2-inch sieve and not more than 20 percent passing a No. 200 sieve and with a plasticity index not greater than 8 percent. Recycled concrete is considered suitable for use as engineered fill even though the percent passing the No. 200 sieve may be greater than 20 percent. Imported fill material shall be approved by Geotechnical Engineer well in advance of fill construction.

- C. Granular Fill: AASHTO Size #57 stone in accordance with the gradation set forth in NJDOT Standard Specifications

2.2 ACCESSORIES – NOT USED

PART 3 EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT

- A. The contractor, subcontractors, and their personnel shall follow the procedures and practices for waste separation, collection and transport as defined in the contractor’s “Waste Management Plan” as required by Division 01 Section "Construction Waste Management."

3.2 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements : Coordination and project conditions.
- B. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- C. Verify structural ability of unsupported walls to support loads imposed by fill.

3.3 PREPARATION

- A. Compact subgrade to density requirements for subsequent backfill materials.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill and compact to density equal to or greater than requirements for subsequent fill material.
- C. Scarify subgrade surface to depth of 6 inches.
- D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.4 BACKFILLING

- A. Backfill areas to contours and elevations with unfrozen materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- C. Place material in continuous layers as follows:
 - 1. General Fill: Maximum 8 inches compacted depth.
 - 2. Structural Fill: Maximum 6 inches compacted depth.
- D. Employ placement method that does not disturb or damage other work.
- E. Maintain optimum moisture content of backfill materials to attain required compaction density.
- F. Backfill against supported foundation walls. Do not backfill against unsupported foundation walls.

- G. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
- H. Slope grade away from building minimum 2 percent slope for minimum distance of 10 ft , unless noted otherwise.
- I. Make gradual grade changes. Blend slope into level areas.
- J. Remove surplus backfill materials from site.
- K. Leave fill material stockpile areas free of excess fill materials.
- L. Structural fill shall be compacted to at least 98 percent of the laboratory determined dry density for footings and 95 percent of the laboratory determined dry density for slab on grade.

3.5 TOLERANCES

- A. Section 01 40 00 - Quality Requirements : Tolerances.
- B. Top Surface of Backfilling Within Building Areas: Plus or minus 1 inch from required elevations.
- C. Top Surface of Backfilling Under Paved Areas. Plus or minus 1 inch from required elevations.
- D. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.6 FIELD QUALITY CONTROL

- A. Perform all work in accordance with Section 31 23 16.

3.7 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 - Execution and Closeout Requirements : Protecting finished work.
- B. Reshape and re-compact fills subjected to vehicular traffic.

END OF SECTION

SECTION 31 25 13

EROSION CONTROLS

PART 1 GENERAL

1.1 STIPULATIONS

- A. The specifications sections “General Conditions of Contract”, “Special Conditions” and “Division 1 – General Requirements” form a part of this section by this reference thereto, and shall have the same force and effect as if printed herewith in full

1.2 SUMMARY

- A. This section includes various erosion and sedimentation control devices that may function in any particular combination as an erosion control system for transportation and site development applications. This work shall consist of temporary control measures ordered by the Engineer during the life of the contract and as shown on the plans, to control erosion and sediment through the use of dikes, berms, dams, sediment basins, fiber mats, netting, gravel, mulches, grasses, and other erosion control devices or methods.
- B. The temporary control provisions contained herein shall be coordinated with the permanent erosion control features (grass, pavement and other restorations) specified elsewhere in the contract to the extent practical to assure economical, effective and continuous erosion control throughout the construction and post-construction period.
- C. The Owner has obtained and paid for an Erosion and Sediment Control adequacy approval for this project. The Contractor shall keep all inspection reports on file and maintain all record keeping requirements to satisfy the approval requirements. The Contractor shall be responsible for and pay all fines, fees, and charges for the Erosion and Sediment Control Plan. The Contractor shall also submit a Discharge Monitoring Report if required at the frequency required by the County Conservation District.
- D. The erosion control measures described herein shall be continued until the construction is complete and final restorations installed.
- E. Section Includes:
 - 1. Silt Barrier Fence.
 - 2. Silt Sock
 - 3. Temporary Seeding.
 - 4. Inlet Protection.
 - 5. Rock Construction Entrances.
 - 6. Sedimentation Controls
 - 7. Temporary and Permanent Erosion Control as shown on the plans.
- F. Related Sections:
 - 1. Section 31 05 13 - Soils for Earthwork.
 - 2. Section 31 05 16 - Aggregates for Earthwork.
 - 3. Section 31 10 00 - Site Clearing.

4. Section 31 23 16 - Excavation.
5. Section 31 23 23 - Fill.
6. Section 32 91 19 - Landscape Grading.
7. Section 32 92 19 - Seeding and Soil Supplements.
8. Division 01 Section "Construction Waste Management"
9. Division 01 Section "Sustainable Design Requirements"

1.3 UNIT PRICE - MEASUREMENT AND PAYMENT – NOT USED

1.4 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 1. AASHTO T88 - Standard Specification for Particle Size Analysis of Soils.
 2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. American Concrete Institute:
 1. ACI 301 - Specifications for Structural Concrete.
- C. ASTM International:
 1. ASTM C127 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
 2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m<sup>3
 - 3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m<sup>3
 - 4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).</sup></sup>
- D. Precast/Prestressed Concrete Institute:
 1. PCI MNL-116S - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.
- E. NJDOT Standard Specifications.
- F. The Standards for Soil Erosion and Sediment Control in New Jersey.

1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Product Data: Submit manufactures data and suppliers information on all sedimentation and erosion control materials and products.

1.6 SUSTAINABLE DESIGN SUBMITTALS

- A. Section 01 81 13 - Sustainable Design Requirements: Requirements for sustainable design submittals.

- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements of Division 01.

1.7 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

1.8 QUALITY ASSURANCE

- A. Perform Work in accordance with Middlesex County Soil Conservation District. In the event of conflict between these requirements and pollution control laws, rules, or regulation of other federal, state, or local agencies, the more restrictive law, rule, or regulation shall govern.

1.9 PRE-INSTALLATION MEETINGS

- A. Section 01 30 00 - Administrative Requirements : Pre-installation meeting.
- B. Convene minimum one week prior to commencing any work on the property with representatives of the Conservation District, County, and Township.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

PART 2 PRODUCTS

2.1 ROCK AND GEOTEXTILE MATERIALS

- A. Furnish in accordance with Middlesex County Soil Conservation District and NJDOT Standard Specifications.
- B. Geotextile Fabric: Geotextile Fabric: Furnish in accordance with Middlesex County Soil Conservation District and NJDOT Standard Specifications at locations shown on the plans or directed in the field.

2.2 PLANTING MATERIALS

- A. Seeding and Soil Supplements: as specified in Section 32 92 19. Furnish in accordance with Middlesex County Soil Conservation District and NJDOT Standard Specifications.
- B. Mulch: as specified in Section 32 92 19. Furnish in accordance with Middlesex County Soil Conservation District and NJDOT Standard Specifications.

- 2.3 INLET FILTERS; SILT SOCKS; TEMPORARY SEEDING; CONSTRUCTION ENTRANCES; SEDIMENTATION CONTROLS; EROSION CONTROL BLANKETS; ETC... Furnish in accordance with Middlesex County Soil Conservation District and NJDOT Standard Specifications and as shown on the drawings
- 2.4 MIXES – NOT USED
- 2.5 SOURCE QUALITY CONTROL (AND TESTS)
 - A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

PART 3 EXECUTION

- 3.1 CONSTRUCTION WASTE MANAGEMENT
 - A. The contractor, subcontractors, and their personnel shall follow the procedures and practices for waste separation, collection and transport as defined in the contractor’s “Waste Management Plan” as required by Division 01 Section "Construction Waste Management.
- 3.2 EXAMINATION
 - A. Section 01 30 00 - Administrative Requirements : Verification of existing conditions before starting work.
 - B. Verify compacted subgrade is acceptable and ready to support devices and imposed loads.
 - C. Verify gradients and elevations of base or foundation for other work are correct.
- 3.3 SITE STABILIZATION
 - A. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time.
 - B. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.
 - C. Stockpile and waste pile heights shall not exceed **35 feet**. Slope stockpile sides at 2: 1 or flatter.
 - D. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 20 days.
 - 1. During non-germinating periods, apply mulch at recommended rates.
 - 2. Stabilize disturbed areas which are not at finished grade and which will be disturbed within one year in accordance with Section 32 92 19 at 75% percent of permanent application rate with no topsoil.
 - 3. Stabilize disturbed areas which are either at finished grade or will not be disturbed within one year in accordance with Section 32 92 19 permanent seeding specifications.
 - E. Stabilize diversion channels, sediment traps, and stockpiles immediately.

3.4 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements, 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.
- C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.5 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.
- B. When sediment accumulation in sedimentation structures has reached a point one-third depth of sediment structure or device, remove and dispose of sediment.
- C. Do not damage structure or device during cleaning operations.
- D. Do not permit sediment to erode into construction or site areas or natural waterways.
- E. Clean channels when depth of sediment reaches approximately one half channel depth.

3.6 PROTECTION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.
- C. Do not permit sediment to erode into construction or site areas or natural waterways
- D. Protect paving from elements, flowing water, or other disturbance until curing is completed.

END OF SECTION

SECTION 320513

SOILS FOR EXTERIOR IMPROVEMENTS

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 STIPULATIONS

- A. The specifications sections “General Conditions of Contract”, “Special Conditions” and “Division 1 – General Requirements” form a part of this section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.3 SUMMARY

- A. Section Includes:

1. Subsoil materials.
2. Topsoil materials.

- B. Related Sections:

1. Section 31 05 13 - Soils for Earthwork.
2. Section 31 22 13 - Rough Grading.
3. Section 31 23 17 - Trenching.
4. Section 31 23 23 - Fill.
5. Section 32 05 16 - Aggregates for Exterior Improvements.
6. Section 32 92 19 - Seeding and Soil Supplements.
7. Geotechnical Engineering Report, dated July 22, 2016 and January 17, 2017, prepared by Maser Consulting, is available for this project. This report is for informational purposes only and should not be considered part of the contract documents. The opinions expressed in this report are those of the Geotechnical Consultant and represent his interpretation of the subgrade conditions, tests, and the results of analysis which he has conducted. Should the data contained in the report not be adequate for the Contractor’s purposes, the Contractor may make, prior to bidding, his own investigation, tests, and analysis.
8. Division 01 Section “Construction Waste Management”
9. Division 01 Section “Sustainable Design Requirements”

1.4 UNIT PRICES - MEASUREMENT AND PAYMENT – NOT USED

1.5 REFERENCES

- A. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

- B. ASTM International:
 - 1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- C. NJDOT Standard Specifications

1.6 SUBMITTALS

- A. Materials Source: Submit name of imported materials source.
- B. Manufacturer's Certificate: Certify Products meet or exceed NJDOT Standard Specifications

1.7 SUSTAINABLE DESIGN SUBMITTALS

- A. Section 01 81 13 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements of Division 01.

1.8 QUALITY ASSURANCE

- A. Furnish each subsoil and topsoil material from single source throughout the Work.
- B. Perform Work in accordance with NJDOT Standard Specifications

PART 2 PRODUCTS

2.1 GENERAL FILL MATERIALS

- A. General Fill shall conform with Division 900 of NJDOT Standard Specifications.
- B. General Fill Material shall be of maximum size that can readily be placed in loose 8-inch layers.
 - 1. Gradation – More than 35% passing No. 200 sieve
 - 2. Minimum dry mass density – 95 lbs per cubic feet determined according to PTM No. 106, Method B.
 - 3. Maximum liquid limit -65, determined according to AASHTO 89
 - 4. Plasticity Index – Not less than liquid limit minus 30, determined according to AASHTO T90 for soils with liquid limits of 41 to 65
- C. General Fill is to be approved by the Geotechnical Engineer

2.2 STRUCTURAL FILL MATERIALS

- A. Structural Fill Materials shall conform to NJDOT Dense Graded Aggregate (DGA) Section 901.10

Structural Fill

US Standard Sieve Size	Percent Finer by Weight
2"	100
¾"	52-100
3/8"	36-70
No. 4	24-50
No. 8	16-38
No. 16	10-30

- B. Structural Fill is to be approved by the Geotechnical Engineer

PART 3

3.1 CONSTRUCTION WASTE MANAGEMENT

- A. The contractor, subcontractors, and their personnel shall follow the procedures and practices for waste separation, collection and transport as defined in the contractor's "Waste Management Plan" as required by Division 01 Section "Construction Waste Management."

3.2 TOPSOIL MATERIALS

- A. Topsoil : Conforming to NJDOT Specification Section 917.01

3.3 SOURCE QUALITY CONTROL

- A. Testing and Analysis of Subsoil Material: Perform in accordance with AASHTO T180.
B. Testing and Analysis of Topsoil Material: Perform in accordance with AASHTO T180.
C. When tests indicate materials do not meet specified requirements, change material and retest.
D. Furnish materials of each type from same source throughout the Work.

PART 4 EXECUTION

4.1 EXCAVATION

- A. Excavate subsoil and topsoil from areas designated.
B. Stockpile excavated material meeting requirements for subsoil materials and topsoil materials.
C. Remove excess excavated materials not intended for reuse, from site.

4.2 STOCKPILING

- A. Stockpile materials on site at locations indicated by Architect/Engineer.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Prevent intermixing of soil types or contamination.
- E. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

4.3 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 32 05 16

AGGREGATES FOR EXTERIOR IMPROVEMENTS

PART 1 GENERAL

1.1 STIPULATIONS

- A. The specifications sections “General Conditions of Contract”, “Special Conditions” and “Division 1 – General Requirements” form a part of this section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.2 SUMMARY

- A. Section Includes:
 - 1. Coarse aggregate materials.
 - 2. Fine aggregate materials.

- B. Related Sections:
 - 1. Section 31 05 16 - Aggregates for Earthwork.
 - 2. Section 31 22 13 - Rough Grading.
 - 3. Section 31 23 17 - Trenching.
 - 4. Section 31 23 23 - Fill.
 - 5. Section 32 05 13 - Soils for Exterior Improvements: Fill and grading materials.
 - 6. Section 32 11 23 - Aggregate Base Courses.
 - 7. Section 32 91 19 - Landscape Grading.
 - 8. Section 33 11 16 - Site Water Utility Distribution Piping.
 - 9. Section 33 31 00 - Sanitary Utility Sewerage Piping.
 - 10. Section 33 41 00 - Storm Utility Drainage Piping.
 - 11. Section 33 51 00 - Natural-Gas Distribution.
 - 12. Geotechnical Engineering Report, dated July 22, 2016 and January 17, 2017, prepared by Maser Consulting is available for this project. This report is for informational purposes only and should not be considered part of the contract documents. The opinions expressed in this report are those of the Geotechnical Consultant and represent his interpretation of the subgrade conditions, tests, and the results of analysis which he has conducted. Should the data contained in the report not be adequate for the Contractor’s purposes, the Contractor may make, prior to bidding, his own investigation, tests, and analysis.
 - 13. Division 01 Section “Construction Waste Management”
 - 14. Division 01 Section “Sustainable Design Requirements”

1.3 UNIT PRICE - MEASUREMENT AND PAYMENT- NOT USED

1.4 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.

2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
5. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

C. NJDOT Standard Specifications

1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures : Requirements for submittals.
- B. Materials Source: Submit name of imported materials suppliers.
- C. Manufacturer's Certificate: Certify Products meet or exceed NJDOT Standard Specifications

1.6 SUSTAINABLE DESIGN SUBMITTALS

- A. Section 01 81 13 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements of Division 01.

1.7 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.
- B. Perform Work in accordance with NJDOT Standard Specifications.

PART 2 PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

- A. Coarse Aggregate : Conforming to NJDOT Standard Specifications, Division 901

2.2 FINE AGGREGATE MATERIALS

- A. Fine Aggregate : Conforming to NJDOT Standard Specification, Division 901

2.3 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements; Testing and inspection services.
- B. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with [ASTM D698.] [ASTM D1557.] [AASHTO T180.] [ASTM D4318.] [ASTM C136.], NJDOT Standard Specifications
- C. Fine Aggregate Material - Testing and Analysis: Perform in accordance with [ASTM D698.] [ASTM D1557.] [AASHTO T180.] [ASTM D4318.] [ASTM C136.], NJDOT Standard Specifications
- D. When tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT

- A. The contractor, subcontractors, and their personnel shall follow the procedures and practices for waste separation, collection and transport as defined in the contractor's "Waste Management Plan" as required by Division 01 Section "Construction Waste Management.

3.2 EXCAVATION

- A. Excavate aggregate materials from on-site locations indicated by Architect/Engineer as specified in Section 31 22 13 .
- B. Stockpile excavated material meeting requirements for coarse aggregate materials and fine aggregate materials.
- C. Remove excess excavated materials not intended for reuse, from site.
- D. Remove excavated materials not meeting requirements for coarse aggregate materials and fine aggregate materials from site.

3.3 STOCKPILING

- A. Stockpile materials on site at locations designated by Architect/Engineer.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.
- D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.4 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 32 11 23

AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 STIPULATIONS

- A. The specifications sections “General Conditions of Contract”, “Special Conditions” and “Division 1 – General Requirements” form a part of this section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.2 SUMMARY

A. Section Includes:

1. Aggregate subbase.

B. Related Sections:

1. Section 31 22 13 - Rough Grading: Preparation of site for base course.
2. Section 31 23 17 - Trenching: Compacted fill under base course.
3. Section 31 23 23 - Fill: Compacted fill under base course.
4. Section 32 05 16 - Aggregates for Exterior Improvements.
5. Section 32 12 16 - Asphalt Paving:
6. Section 32 13 13 - Concrete Paving: Finish concrete surface course.
7. Section 32 91 19 - Landscape Grading: Topsoil fill at areas adjacent to aggregate base course.
8. Section 33 05 13 - Manholes and Structures.
9. Division 01 Section “Construction Waste Management”
10. Division 01 Section “Sustainable Design Requirements”

1.3 UNIT PRICE - MEASUREMENT AND PAYMENT – NOT USED

1.4 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
6. ASTM D2940 - Standard Specification for Graded Aggregate Material For Bases or Subbases for Highways or Airports.
7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

C. NJDOT Standard Specifications

1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data:
 1. Submit data for geotextile fabric and herbicide.
- C. Materials Source: Submit name of aggregate materials suppliers.
- D. Manufacturer's Certificate: Certify Products meet or exceed NJDOT's standards

1.6 SUSTAINABLE DESIGN SUBMITTALS

- A. Section 01 81 13 - Sustainable Design Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements of Division 01.

1.7 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.
- B. Perform Work in accordance with NJDOT's standards.

PART 2 PRODUCTS

2.1 AGGREGATE MATERIALS

- A. Subbase Aggregate: NJDOT Specification 901.05

PART 3 EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT

- A. The contractor, subcontractors, and their personnel shall follow the procedures and practices for waste separation, collection and transport as defined in the contractor's "Waste Management Plan" as required by Division 01 Section "Construction Waste Management."

3.2 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements Verification of existing conditions before starting work.
- B. Verify compacted substrate is dry and ready to support paving and imposed loads.
 - 1. Proof roll substrate with 20 ton vibratory roller in minimum two perpendicular passes to identify soft spots.
 - 2. Remove soft substrate and replace with compacted fill as specified in Section 31 23 23 .
- C. Verify substrate has been inspected, gradients and elevations are correct.

3.3 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place fill on soft, muddy, or frozen surfaces.

3.4 AGGREGATE PLACEMENT

- A. Spread aggregate over prepared substrate to total compacted thickness indicated on Drawings.
- B. Roller compact aggregate to 95 percent maximum density.
- C. Level and contour surfaces to elevations, profiles, and gradients indicated.
- D. Add small quantities of fine aggregate to coarse aggregate when required to assist compaction.
- E. Maintain optimum moisture content of fill materials to attain specified compaction density.
- F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.5 TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Maximum Variation From Flat Surface: ½ inch measured with 10 foot straight edge.
- C. Maximum Variation From Thickness: 1/4 inch .
- D. Maximum Variation From Elevation: 1/2 inch .

3.6 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements 01 70 00 - Execution and Closeout Requirements : Field inspecting, testing, adjusting, and balancing.
- B. Compaction testing will be performed in accordance with AASHTO T310.

- C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- D. Frequency of Tests: One test for every 1000 square yards of each layer compacted aggregate.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Asphalt materials.
2. Aggregate materials.
3. Aggregate subbase.
4. Asphalt paving base course, binder course, and wearing course.
5. Asphalt paving overlay for existing paving.

B. Related Sections:

1. Section 31 22 13 - Rough Grading
2. Section 31 23 23 - Fill
3. Section 32 05 16 - Aggregates for Exterior Improvements
4. Section 32 11 23 - Aggregate Base Courses
5. Section 32 17 23 - Pavement Markings: Painted pavement markings, lines, and legends.
6. Section 33 05 13 - Manholes and Structures:

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT – NOT USED

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO M17 - Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
2. AASHTO M29 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
3. AASHTO M140 - Standard Specification for Emulsified Asphalt.
4. AASHTO M320 - Standard Specification for Performance-Graded Asphalt Binder.
5. AASHTO M324 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
6. AASHTO MP1a - Standard Specification for Performance-Graded Asphalt Binder.

B. Asphalt Institute:

1. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot- Mix Types.
2. AI MS-19 - Basic Asphalt Emulsion Manual.
3. AI SP-2 - Superpave Mix Design.

C. ASTM International:

1. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
2. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
3. ASTM D242 - Standard Specification for Mineral Filler For Bituminous Paving Mixtures.
4. ASTM D692 - Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.

5. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
6. ASTM D977 - Standard Specification for Emulsified Asphalt.
7. ASTM D1073 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
8. ASTM D1188 - Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
9. ASTM D2027 - Standard Specification for Cutback Asphalt (Medium-Curing Type).
10. ASTM D2397 - Standard Specification for Cationic Emulsified Asphalt.
11. ASTM D2726 - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
12. ASTM D2950 - Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.
13. ASTM D3381 - Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.
14. ASTM D3515 - Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
15. ASTM D3549 - Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
16. ASTM D3910 - Standard Practices for Design, Testing, and Construction of Slurry Seal.
17. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
18. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
19. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
20. ASTM E1918 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
21. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

D. NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data:
 1. Submit product information for asphalt and aggregate materials.
 2. Submit mix design with laboratory test results supporting design.
 3. Submit certification that the product is an approved NJDOT mix design.
- C. Manufacturer's Certificate: Certify Products meet or exceed NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

1.5 QUALITY ASSURANCE

- A. Mixing Plant: Conform to NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
- B. Obtain materials from same source throughout.
- C. Perform Work in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

1.6 QUALIFICATIONS

- A. Installer: Company specializing in performing work of this section with minimum 5 years documented experience.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not place asphalt mixture when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 - PRODUCTS

2.1 ASPHALT MATERIALS

- A. Asphalt Cement: In accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
- B. Tack Coat: In accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

2.2 AGGREGATE MATERIALS

- A. Coarse Aggregate: In accordance with Section 31 05 16 .In accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
- B. Fine Aggregate: In accordance with Section 31 05 16; natural sand or sand manufactured from stone, gravel, or blast furnace slag. In accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

2.3 MIXES

- A. Use dry material to avoid foaming. Mix uniformly.
- B. Asphalt Paving Mixtures: Designed in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended with maximum 15 percent by weight reclaimed asphalt pavement.
 - 1. Base Course: As indicated on the drawings
 - 2. Wearing Course: As indicated on the drawings

2.4 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Testing requirements.
- B. Submit proposed mix design of each class of mix for review prior to beginning of Work.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.
- C. Verify compacted subbase is dry and ready to support paving and imposed loads.
 - 1. Prepare subbase in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
 - 2. Remove soft subbase and replace with compacted fill as specified in Section 31 23 23
- D. Verify gradients and elevations of base are correct.
- E. Verify gutter drainage grilles and frames and manhole frames are installed in correct position and elevation.

3.2 SUBBASE

- A. Prepare subbase in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

3.3 EXISTING WORK

- A. Saw cut and notch existing paving.
- B. Clean existing paving to remove foreign material, excess joint sealant and crack filler from paving surface.
- C. Repair surface defects in existing paving to provide uniform surface to receive new paving.

3.4 TACK COAT

- A. Apply tack coat at a rate of .1 gal/SY in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
- B. Apply tack coat to contact surfaces of curbs and gutters.
- C. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt paving. Do not tack coat these surfaces.

3.5 SINGLE COURSE ASPHALT PAVING

- A. Install Work in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
- B. Place asphalt within 24 hours of applying primer or tack coat.
- C. Place asphalt wearing course to thickness indicated on Drawings.

- D. Compact paving by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
 - E. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.
- 3.6 ASPHALT PAVING OVERLAY
- A. Apply tack coat to existing paving surface at .10 gal/sy.
 - B. Place wearing course to thickness indicated on Drawings.
 - C. Compact overlay by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
 - D. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.
- 3.7 ERECTION TOLERANCES
- A. Section 01 40 00 - Quality Requirements Tolerances.
 - B. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
 - C. Scheduled Compacted Thickness: Within 1/4 inch.
 - D. Variation from Indicated Elevation: Within 1/2 inch.
- 3.8 FIELD QUALITY CONTROL
- A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
 - B. Install work in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
- 3.9 PROTECTION OF FINISHED WORK
- A. Immediately after placement, protect paving from mechanical injury for 24 hours or until surface temperature is less than 140 degrees F.

END OF SECTION

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SECTION 32 13 13
CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aggregate subbase.
 - 2. Concrete paving for:
 - a. Concrete sidewalks.
 - b. Concrete curbs.

- B. Related Sections:
 - 1. Section 09 90 00 - Painting and Coating
 - 2. Section 31 22 13 - Rough Grading
 - 3. Section 31 23 23 - Fill
 - 4. Section 32 11 23 - Aggregate Base Courses.
 - 5. Section 32 12 16 - Asphalt Paving:
 - 6. Section 32 91 19 - Landscape Grading
 - 7. Section 33 05 13 - Manholes and Structures:

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT - NOT USED

1.3 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO M324 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

- B. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

- C. ASTM International:
 - 1. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
 - 2. ASTM A185/A185M - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
 - 3. ASTM A497/A497M - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
 - 4. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 5. ASTM A775/A775M - S Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
 - 6. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
 - 7. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
 - 8. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

9. ASTM C33 - Standard Specification for Concrete Aggregates.
10. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
11. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
12. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
13. ASTM C150 - Standard Specification for Portland Cement.
14. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
15. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
16. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
17. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
18. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
19. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
20. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
21. ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete.
22. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
23. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
24. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
25. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
26. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
27. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
28. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
29. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

D. NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

1.4 SUBMITTALS

- A. Product Data:
 1. Submit data on concrete materials, joint filler, admixtures, curing compounds.
 2. Provide certification that the product is an approved NJDOT mix design.
- B. Design Data:
 1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
 - a. Hot and cold weather concrete work.
 2. Identify mix ingredients and proportions, including admixtures.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301 and requirements of Section 03 10 00, Section 03 20 00 and Section 03 30 00.
- B. Obtain cementitious materials from same source throughout.

- C. Perform Work in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing work of this section with minimum 3 years experience.

1.7 MOCKUP – NOT USED

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. Form Materials: Conform to ACI 301.
- B. Joint Filler: ASTM D1751; Asphalt impregnated fiberboard or felt, 1/2 inch thick.

2.2 REINFORCING

- A. Reinforcing Steel and Wire Fabric: Type specified in Section 03 20 00 and as shown on the project drawings.
- B. Welded Plain Wire Fabric: ASTM A185/A185M; in flat sheets at locations shown on the project drawings.

2.3 CONCRETE MATERIALS

- A. Concrete Materials: As specified in Section 03 30 00 Provide in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
- B. Fine and Coarse Aggregates: ASTM C33, as specified in Section 3105 16.
- C. Water: ASTM C94/C94M; potable, not detrimental to concrete
- D. Air Entrainment: ASTM C260.
- E. Chemical Admixture: ASTM C494/C494M.
 - 1. Type A - Water Reducing.
 - 2. Type B - Retarding.

2.4 ACCESSORIES

- A. Curing Compound: Per NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
- B. Joint Sealers: Per NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

2.5 CONCRETE MIX - BY PERFORMANCE CRITERIA

- A. Mix and deliver concrete in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
- B. Select proportions for normal weight concrete in accordance with ACI 301 Method 1.
- C. Provide concrete to the strength and/or mix design specified on the drawings.
- D. Use accelerating admixtures in cold weather only when approved by the Architect/Engineer in writing. Use of admixtures will not relax cold weather placement requirements.
- E. Use calcium chloride only when approved by the Architect/Engineer in writing.
- F. Use set retarding admixtures during hot weather only when approved by the Architect/Engineer in writing.

2.6 SOURCE QUALITY CONTROL AND TESTS

- A. Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of Work.
- B. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements.
- C. Test samples in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify compacted subgrade is dry and ready to support paving and imposed loads.
 - 1. Remove soft subbase and replace with compacted fill as specified in Section 31 23 23
- B. Verify gradients and elevations of base are correct.

3.2 SUBBASE

- A. Aggregate Subbase: Install as specified in Section 32 11 23
- B. Prepare subbase in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended...

3.3 PREPARATION

- A. Moisten substrate to minimize absorption of water from fresh concrete.
- B. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete paving.
- C. Notify the Township Engineer and Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

3.4 FORMING

- A. Place and secure forms and screeds to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

3.5 REINFORCING

- A. Place reinforcing as indicated on Drawings.
- B. Interrupt reinforcing at contraction or expansion joints.

3.6 PLACING CONCRETE

- A. Place concrete in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
- B. Ensure reinforcing, inserts, embedded parts, formed joints are not disturbed during concrete placement.
- C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

3.7 JOINTS

- A. Place expansion joints at 20 foot intervals. Align curb, gutter, and sidewalk joints.
- B. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/4 inch for sealant installation.
- C. Provide scored joints at intervals, and pattern, as indicated on the drawings.
- D. Provide keyed joints as indicated.

3.8 FINISHING

- A. Sidewalk Paving: Light broom, radius to 1/2 inch radius, and trowel joint edges, Wood float.
- B. Curbs and Gutters: Light broom.
- C. Direction of Texturing: Transverse to paving direction.

3.9 CURING AND PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Cure surfaces in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

3.10 ERECTION TOLERANCES

- A. Maximum Variation of Surface Flatness: ¼ inch in 10 ft.
- B. Maximum Variation From True Position: 1/4 inch.
- C. Maximum cross slope for sidewalks: 2%
- D. Maximum longitudinal slope for sidewalks along an accessible route: 5%

3.11 FIELD QUALITY CONTROL

- A. Inspect reinforcement placement for size, spacing, location, support.
- B. Testing firm will take cylinders and perform slump tests in accordance with ACI 301
- C. All work shall comply with Section 03 00 00.

3.12 PROTECTION

- A. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Do not permit pedestrian or vehicular traffic over paving for 7 days minimum after finishing. Until 75 percent design strength of concrete has been achieved.

END OF SECTION

SECTION 32 14 13

PRECAST CONCRETE UNIT PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete paver units.
 - 2. Sand bed and sand joint.
- B. Related Sections:
 - 1. Section 31 23 23 - Fill
 - 2. Section 32 91 19 - Landscape Grading
 - 3. Section 32 11 23 – Aggregate Base Courses
 - 4. Section 33 05 13 - Manholes and Structures:

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT – NOT USED

1.3 REFERENCES

- A. ASTM International:
 - 1. ASTM C33 - Standard Specification for Concrete Aggregates.
 - 2. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
 - 3. ASTM C936 - Standard Specification for Solid Concrete Interlocking Paving Units.
 - 4. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emisometers.
 - 5. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
 - 6. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
 - 7. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
 - 8. ASTM E1918 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
 - 9. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

1.4 SUBMITTALS

- A. Product Data: Submit characteristics of paver unit, dimensions, and special shapes.
- B. Samples: Submit two samples of each paver size, illustrating style, size, color range and surface texture of units being provided.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with the drawings and NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing work of this section with minimum five years documented experience.

1.7 MOCKUP – NOT USED

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND MATERIALS

- A. As specified on the project drawings, or approved equal.
- B. Sand for Setting Bed: ASTM C33 clean river or bank sand containing maximum of 30 percent particle size of No. 10 (2 mm) sieve. Stone dust may be substituted as approved by the Engineer.
- C. Sand for Joints: Clean, washed fine sand conforming to the requirements of NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Compact and prepare substrate in conformance with 32 11 23 Aggregate Base Courses.
- B. Verify that substrate is level or to correct gradient, smooth, capable of supporting pavers and imposed loads, and ready to receive Work of this section.
- C. Verify gradients and elevations of substrate are correct.

3.2 INSTALLATION

- A. Spread sand or stone dust evenly over prepared substrate surface to a thickness of 2 inches
- B. Dampen and roller compact sand to level and even surface.
- C. Screed and scarify top 1/2 inch of sand.
- D. Place paver units in the pattern specified on the project drawings.
 - 1. Joint Width: 3/8 inches.
- E. Sprinkle sand over surface and sweep into joints. Moisten joints and recover with additional sand until firm joints are achieved. Remove excess sand.
- F. Tamp and level paver units with mechanical vibrator until units are firmly bedded, level, and to correct elevation and gradients. Do not tamp unrestrained edges.

- G. Recover with additional sand, sweep into joints and hollow areas of pavers. Remove excess sand.

END OF SECTION

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SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Traffic lines and markings.
2. Legends.
3. Paint.
4. Glass beads.

B. Related Sections:

1. Section 32 12 16 - Asphalt Paving.
2. Section 32 13 13 - Concrete Paving.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT – NOT USED

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO M247 - Standard Specification for Glass Beads Used in Traffic Paint.

B. ASTM International:

1. ASTM D34 - Standard Guide for Chemical Analysis of White Pigments.
2. ASTM D126 - Standard Test Methods for Analysis of Yellow, Orange, and Green Pigments Containing Lead Chromate and Chromium Oxide Green.
3. ASTM D562 - Standard Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer.
4. ASTM D711 - Standard Test Method for No-Pick-Up Time of Traffic Paint.
5. ASTM D713 - Standard Practice for Conducting Road Service Tests on Fluid Traffic Marking Materials.
6. ASTM D969 - Standard Test Method for Laboratory Determination of Degree of Bleeding of Traffic Paint.
7. ASTM D1301 - Standard Test Methods for Chemical Analysis of White Lead Pigments.
8. ASTM D1394 - Standard Test Methods for Chemical Analysis of White Titanium Pigments.
9. ASTM D1475 - Standard test Method for Density of Liquid Coatings, Inks, and Related Products.
10. ASTM D1640 - Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature.
11. ASTM D2202 - Standard Test Method for Slump of Sealants.
12. ASTM D2371 - Standard Test Method for Pigment Content of Solvent-Reducible Paints.
13. ASTM D2621 - Standard Test Method for Infrared Identification of Vehicle Solids From Solvent-Reducible Paints.
14. ASTM D2743 - Standard Practices for Uniformity of Traffic Paint Vehicle Solids by Spectroscopy and Gas Chromatography.

C. NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

1.4 PERFORMANCE REQUIREMENTS

- A. Paint Adhesion: Adhere to road surface forming smooth continuous film one minute after application.
- B. Paint Drying: Tack free by touch so as not to require coning or other traffic control devices to prevent transfer by vehicle tires within two minutes after application.

1.5 SUBMITTALS

- A. Product Data: Submit paint formulation for each type of paint.
- B. Test Reports: Submit source and acceptance test results in accordance with AASHTO M247.
- C. Manufacturer's Installation Instructions: Submit instructions for application temperatures, eradication requirements, application rate, line thickness, type of glass beads, bead embedment and bead application rate, and any other data on proper installation.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

1.7 QUALIFICATIONS

- A. Applicator: Company specializing in performing work of this section with minimum 5 years experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Invert containers several days prior to use when paint has been stored more than 2 months. Minimize exposure to air when transferring paint. Seal drums and tanks when not in use.
- B. Glass Beads. Store glass beads in cool, dry place. Protect from contamination by foreign substances.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.
- B. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.
- C. Do not apply paint when temperatures are expected to fall below 50 degrees F for 24 hours after application.
- D. Volatile Organic Content (VOC). Do not exceed State or Environmental Protection Agency maximum VOC on traffic paint.

1.10 WARRANTY

- A. Furnish three year manufacturer's warranty for traffic paints.

PART 2 - PRODUCTS

2.1 PAINTED PAVEMENT MARKINGS

- A. Furnish materials in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
- B. Paint: In accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

2.2 EQUIPMENT

- A. For application of crosswalks, intersections, stop lines, legends and other miscellaneous items by walk behind strippers, hand spray or stencil trucks, apply with equipment meeting requirements of this section. Do not use hand brushes or rollers. Optionally apply glass beads by hand.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not apply paint to concrete surfaces until concrete has cured for 28 days.

3.2 PREPARATION

- A. Maintenance and Protection of Traffic:
 - 1. Provide short term traffic control
 - 2. Prevent interference with marking operations and to prevent traffic on newly applied markings before markings dry.
 - 3. Maintain travel lanes between 7: 00 AM to 9: 00 AM, and between 4: 00 PM and 6: 00 PM.
- B. Surface Preparation.
 - 1. Clean and dry paved surface prior to painting.
 - 2. Blow or sweep surface free of dirt, debris, oil, grease or gasoline.

3.3 EXISTING WORK

- A. Remove existing markings in an acceptable manner. Do not remove existing pavement markings by painting over with blank paint. Remove by methods that will cause least damage to pavement structure or pavement surface. Satisfactorily repair any pavement or surface damage caused by removal methods.
- B. Clean and repair existing lines and legends.

3.4 APPLICATION

- A. Install Work in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

3.5 APPLICATION TOLERANCES

- A. Maximum Variation from Wet Film Thickness: 1 mil.

- B. Maximum Variation from Wet Paint Line Width: Plus or minus 1/8 inch.

3.6 FIELD QUALITY CONTROL

- A. Inspect for incorrect location, insufficient thickness, line width, coverage, retention, uncured or discolored material, and insufficient bonding.
- B. Repair lines and markings, which after application and curing do not meet following criteria:
 - 1. Incorrect Location: Remove and replace incorrectly placed patterns.
 - 2. Insufficient Thickness, Line Width, Paint Coverage, Glass Bead Coverage or Retention: Prepare defective material by acceptably grinding or blast cleaning to remove substantial amount of beads and to roughen marking surface. Remove loose particles and debris. Apply new markings on cleaned surface in accordance with this Section.
 - 3. Uncured or Discolored Material, Insufficient Bonding: Remove defective markings in accordance with this Section and clean pavement surface one foot beyond affected area. Apply new markings on cleaned surface in accordance with this Section.
- C. Replace defective pavement markings as specified throughout 3 year warranted period. Replace markings damaged by anti-skid materials, studded tires, tire chains, chemical deicers, and snow plowing or other loss of marking material regardless of cause. When markings are damaged by pavement failure or by Owner's painting, crack sealing, or pavement repair operations, Contractor is released from warranty requirements for damaged work.
- D. Prepare list of defective areas and areas requiring additional inspection and evaluation to decide where material may need replaced. Provide traffic control as necessary if markings require more detailed evaluation.
- E. Replace pavement marking material under warranty using original or better type material. Continue warranty to end of original 3 year period even when replacement materials have been installed as specified.
- F. When eradication of existing paint lines is necessary, eradicate by shot blast or water blast method. Do not gouge or groove pavement more than 1/16 inch during removal. Limit area of removal to area of marking plus 1 inch on all sides. Prevent damage to transverse and longitudinal joint sealers, and repair any damage according to requirements in Section 32 13 13 or Section 32 12 16.
- G. Maintain daily log showing work completed results of above inspections or tests, pavement and air temperatures, relative humidity, presence of any moisture on pavement, and any material or equipment problems. Make legible entries in log in ink, sign and submit by end of each work day. Enter environmental data into log prior to starting work each day and at two additional times during day.

3.7 PROTECTION OF FINISHED WORK

- A. Protect painted pavement markings from vehicular and pedestrian traffic until paint is dry and track free. Follow manufacturer's recommendations or use minimum of 30 minutes. Consider barrier cones as satisfactory protection for materials requiring more than 2 minutes dry time.

END OF SECTION

SECTION 32 91 13
SOIL PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparation of subsoil.
2. Soil testing.
3. Placing topsoil.

B. Related Sections:

1. Section 31 22 13 - Rough Grading
2. Section 31 23 17 - Trenching
3. Section 32 05 13 - Soils for Exterior Improvements
4. Section 32 91 19 - Landscape Grading
5. Section 32 92 19 - Seeding
6. Section 32 93 00 - Plants.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT – NOT USED

1.3 SUBMITTALS

- A. Test Reports: Indicate topsoil nutrient and pH levels with recommended soil supplements and application rates.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Topsoil: As specified in Section 32 05 13; 31 05 13.

2.2 SOURCE QUALITY CONTROL

- A. Provide recommendation for fertilizer and lime application rates for specified seed mix as result of testing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify prepared soil base is ready to receive the Work of this section.

3.2 PREPARATION OF SUBSOIL

- A. Prepare sub-soil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
- B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated sub-soil.
- C. Scarify subsoil to depth of 3 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.

3.3 PLACING TOPSOIL

- A. Spread topsoil to minimum depth of 4 inches over area to be seeded. Rake until smooth.
- B. Place topsoil during dry weather and on dry unfrozen subgrade.
- C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.
- D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

END OF SECTION

SECTION 32 91 19

LANDSCAPE GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Final grade topsoil for finish landscaping.

B. Related Sections:

1. Section 31 22 13 - Rough Grading
2. Section 31 23 17 - Trenching
3. Section 31 23 23 - Fill
4. Section 32 05 13 - Soils for Exterior Improvements
5. Section 32 92 19 - Seeding
6. Section 32 93 00 - Plants

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT – NOT USED

1.3 SUBMITTALS

- ###### A. Materials Source: Submit name of imported materials source.

1.4 QUALITY ASSURANCE

- ###### A. Furnish each topsoil material from single source throughout the Work.
- ###### B. Perform work in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

PART 2 - PRODUCTS

2.1 MATERIAL

- ###### A. Topsoil: As specified in Section 32 05 13; 31 05 13

PART 3 - EXECUTION

3.1 EXAMINATION

- ###### A. Verify building and trench backfilling have been inspected.
- ###### B. Verify substrate base has been contoured and compacted.

3.2 PREPARATION

- ###### A. Protect landscaping and other features remaining as final Work.

- B. Protect existing structures, fences, sidewalks, utilities, paving, and curbs.
- 3.3 SUBSTRATE PREPARATION
- A. Eliminate uneven areas and low spots.
 - B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove contaminated subsoil.
 - C. Scarify surface to depth of 3 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.
- 3.4 PLACING TOPSOIL
- A. Place topsoil in areas where seeding, planting, is required. Place topsoil during dry weather.
 - B. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.
 - C. Remove roots, weeds, rocks, and foreign material while spreading.
 - D. Manually spread topsoil close to plant material to prevent damage.
 - E. Lightly compact placed topsoil.
 - F. Remove surplus subsoil and topsoil from site.
 - G. Leave stockpile area and site clean and raked, ready to receive landscaping.
- 3.5 TOLERANCES
- A. Top of Topsoil: Plus or minus 1/2 inch.
- 3.6 PROTECTION OF INSTALLED WORK
- A. Prohibit construction traffic over topsoil.

END OF SECTION

SECTION 32 92 19

SEEDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fertilizing.
2. Seeding.
3. Hydroseeding.
4. Mulching.
5. Maintenance.

B. Related Sections:

1. Section 31 22 13 - Rough Grading
2. Section 31 23 17 - Trenching
3. Section 32 05 13 - Soils for Exterior Improvements
4. Section 32 91 13 - Soil Preparation
5. Section 32 91 19 - Landscape Grading
6. Section 32 93 00 - Plants.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT – NOT USED

1.3 REFERENCES

A. ASTM International:

1. ASTM C602 - Standard Specification for Agricultural Liming Materials.

B. NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

1.4 DEFINITIONS

- ###### A. Weeds: Vegetative species other than specified species to be established in given area.

1.5 SUBMITTALS

- ###### A. Product Data: Submit data for seed mix, fertilizer, and mulch, and other accessories.

- ###### B. Provide certification that the seed mix is approved by the Freehold Soil Conservation District.

1.6 CLOSEOUT SUBMITTALS

- ###### A. Operation and Maintenance Data: Include maintenance instructions, cutting method and maximum grass height;

1.7 QUALITY ASSURANCE

- A. Provide seed mixture in containers showing percentage of seed mix, germination percentage, inert matter percentage, weed percentage, year of production, net weight, date of packaging, and location of packaging.
- B. Perform Work in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
- C. Perform Work in accordance with the approved Soil Erosion and Sediment Control Plan and Freehold Soil Conservation District requirements.

1.8 QUALIFICATIONS

- A. Seed Supplier: Company specializing in manufacturing Products specified in this section with minimum three years experience.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.10 MAINTENANCE SERVICE

- A. Maintain seeded areas immediately after placement until grass is well established and exhibits vigorous growing condition for two cuttings.

PART 2 - PRODUCTS

2.1 SEED MIXTURE

- A. Furnish materials in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
- B. Seed Mixture: As specified on the plans in accordance with County Conservation District standards

2.2 ACCESSORIES

- A. Mulching Material: As specified on the project drawings.
- B. Fertilizer: As specified on the project drawings.
- C. Lime: ASTM C602, Class T agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.
- D. Water: Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.

2.3 SOURCE QUALITY CONTROL

- A. Provide recommendation for fertilizer and lime application rates for specified seed mix as result of testing.
- B. Testing is not required when recent tests and certificates are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify prepared soil base is ready to receive the Work of this section.
- B. Any areas of soil compaction shall be scarified.

3.2 FERTILIZING

- A. Apply lime at application rate recommended by soil analysis. Work lime into top 6 inches of soil.
- B. Apply fertilizer at application rate recommended by soil analysis.
- C. Apply after smooth raking of topsoil
- D. Do not apply fertilizer at same time or with same machine used to apply seed.
- E. Mix fertilizer thoroughly into upper 2 inches of topsoil.
- F. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

3.3 SEEDING

- A. Apply seed at rate as specified on the plans evenly in two intersecting directions. Rake in lightly.
- B. Do not seed areas in excess of that which can be mulched on same day.
- C. Planting Season: Per County Conservation District regulations
- D. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph
- E. Immediately following seeding and compacting, apply mulch to thickness of 1/8 inches. Maintain clear of shrubs and trees.
- F. Apply water with fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

3.4 HYDROSEEDING

- A. Apply fertilizer, mulch and seeded slurry with hydraulic seeder at rate specified by the County Conservation District. Hydroseeding may only be performed during the optimum seeding season.
- B. After application, apply water with fine spray immediately after each area has been hydroseeded. Saturate to 4 inches of soil and maintain moisture levels two to four inches.

3.5 SEED PROTECTION

- A. Cover seeded slopes where grade is 3:1 or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.
- B. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep excavated topsoil trench. Overlap edges and ends of adjacent rolls minimum 12 inches. Backfill trench and rake smooth, level with adjacent soil.
- C. Secure outside edges and overlaps at 36 inch intervals with stakes.
- D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
- E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches .

3.6 MAINTENANCE

- A. Mow grass at regular intervals to maintain at maximum height of 2-1/2 inches . Do not cut more than 1/3 of grass blade at each mowing. Perform first mowing when seedlings are 40 percent higher than desired height.
- B. Neatly trim edges and hand clip where necessary.
- C. Immediately remove clippings after mowing and trimming. Do not let clippings lay in clumps.
- D. Water to prevent grass and soil from drying out.
- E. Control growth of weeds. Apply herbicides. Remedy damage resulting from improper use of herbicides.
- F. Immediately reseed areas showing bare spots.
- G. Repair washouts or gullies.
- H. Protect seeded areas with warning signs during maintenance period.

END OF SECTION

SECTION 32 93 00

PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparation of subsoil and topsoil.
2. Topsoil bedding.
3. Trees, plants, and ground cover.
4. Mulch.
5. Fertilizer.
6. Maintenance.

B. Related Sections:

1. Section 31 23 17 - Trenching
2. Section 31 23 23 - Fill
3. Section 32 05 13 - Soils for Exterior Improvements
4. Section 32 91 19 - Landscape Grading
5. Section 32 92 19 - Seeding and Soil Supplements.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT – NOT USED

1.3 REFERENCES

A. American National Standards Institute:

1. ANSI A300 - Tree Care Operations - Tree, Shrub and Other Woody Plant Maintenance - Standard Practices.
2. ANSI Z60.1 - Nursery Stock.

B. Forest Stewardship Council:

1. FSC Guidelines - Forest Stewardship Council Guidelines.

C. NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

1.4 DEFINITIONS

A. Weeds: Vegetative species other than specified species to be established in given area.

B. Plants: Living trees, plants, and ground cover specified in this Section, and described in ANSI Z60.1.

1.5 SUBMITTALS

A. Product Data: Submit list of plant material sources, data for fertilizer and other accessories.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

B. Perform Work in accordance with the project drawings.

1.7 QUALIFICATIONS

A. Nursery: Company specializing in growing and cultivating plants with three years' experience.

B. Installer: Company specializing in installing and planting plants with 3 years experience

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

B. Protect and maintain plant life until planted.

C. Deliver plant life materials immediately prior to placement. Keep plants moist.

D. Plant material damaged as a result of delivery, storage or handling will be rejected.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not install plant life when ambient temperatures may drop below 35 degrees F or rise above 90 degrees F.

B. Refer to project drawings for specific requirements for planting, including limitations on spring and fall planting for each species.

C. Do not install plant life when wind velocity exceeds 30 mph.

1.10 WARRANTY

A. Furnish one year manufacturer warranty for trees, plants, and ground cover.

1.11 MAINTENANCE SERVICE

A. Maintain plant life immediately after placement until plants are well established and exhibit vigorous growing condition. Maintenance includes:

1. Cultivation and weeding plant beds and tree pits.
2. Applying herbicides for weed control. Remedy damage resulting from use of herbicides.
3. Remedy damage from use of insecticides.
4. Irrigating sufficient to saturate root system.
5. Pruning, including removal of dead or broken branches.
6. Disease control.
7. Maintaining guys, turnbuckles, and stakes. Turnbuckles are to be slack unless tightening is needed to ensure the tree is plumb. Repair or replace accessories when required. All stakes and staking material are to be removed after 1 year.
8. Replacement of mulch.

PART 2 - PRODUCTS

2.1 TREES, PLANTS, AND GROUND COVER

- A. Planting Stock:
 - 1. Species: In accordance with Standardized Plant Names, official code of American Joint Committee on Horticulture Nomenclature.
 - 2. Identification: Label individual plants or each bundle of plants when tied in bundles.
 - 3. Plants: No. 1 Grade conforming to "American Standard for Nursery Stock" of American Association of Nurserymen (AAN); well-branched, vigorous and balanced root and top growth; free from disease, injurious insects, mechanical wounds, broken branches, decay and other defects.
 - 4. Trees: Furnish with reasonably straight trunks, well balanced tops, and single leader.
 - 5. Deciduous plants: Furnish in dormant state, except those specified as container grown.
- B. Trees Plants and Ground Cover: Species and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the Work.

2.2 SOIL MATERIALS

- A. Topsoil: As specified in Section 32 05 13

2.3 SOIL AMENDMENT MATERIALS

- A. When soil tests indicate soil amendment, apply soil conditioners or fertilizers to amend soil to specified conditions.
 - 1. Tree Fertilizer: Containing fifty percent of elements derived from organic sources; of proportion necessary to eliminate deficiencies of topsoil ,as indicated in analysis
 - 2. Peat Moss: Shredded, loose, sphagnum moss; free of lumps, roots, inorganic material or acidic materials; minimum of 85 percent organic material measured by oven dry weight, pH range of 4 to 5; moisture content of 30 percent.
- B. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates.
- C. Water: Clean, fresh, and free of substances or matter capable of inhibiting vigorous growth of plants.

2.4 MULCH MATERIALS

- A. Mulching Material: Composted, shredded hardwood bark, dark brown in color.

2.5 ACCESSORIES

- A. Wrapping Materials: Burlap.
- B. Stakes: Softwood lumber, pointed end
- C. Cable, Wire, Eye Bolts and Turnbuckles: Non-corrosive, of sufficient strength to withstand wind pressure and resulting movement of plant life.
- D. Plant Protectors: Rubber sleeves over cable to protect plant stems, trunks, and branches.

2.6 PLANT SOIL MIX

- A. Plant Soil Mix: Uniform mixture of 1 part peat and 3 parts topsoil by volume.

2.7 SOURCE QUALITY CONTROL

- A. Provide recommendation for fertilizer and soil amendment application rates for specified planting as result of testing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify prepared subsoil is ready to receive work.
- B. Saturate soil with water to test drainage.

3.2 PREPARATION OF SUBSOIL

- A. Prepare subsoil to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
- B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.
- C. Scarify subsoil to depth of 3 inches where plants are to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.
- D. Dig pits and beds three times wider than plant root system.

3.3 PLACING TOPSOIL

- A. Spread topsoil to minimum depth of 6 inches over area to be planted. Rake smooth.
- B. Place topsoil during dry weather and on dry unfrozen subgrade.
- C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.
- D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.
- E. Install topsoil into pits and beds intended for plant root balls, to minimum thickness of 6 inches

3.4 FERTILIZING

- A. Apply starter fertilizer in accordance with manufacturers recommendations
- B. Apply after initial raking of topsoil.
- C. Mix thoroughly into upper 2 inches of topsoil.
- D. Lightly water soil to aid dissipation of fertilizer.

3.5 PLANTING

- A. Place plants for best appearance for review and final orientation by Architect/Engineer.
- B. Set plants vertical.
- C. Remove non-biodegradable root containers and rope and plastic from trunk and branches prior to planting.
- D. Set plants in pits or beds, partly filled with prepared plant mix, at minimum depth of 6 inches [as indicated on Drawings under each plant. All of the wire basket is to be removed and all of the ropes and burlap must be removed from the top 2/3 of the rootball.
- E. Place bare root plant materials so roots lie in natural position. Backfill soil mixture in 6 inch layers. Maintain plant life in vertical position.
- F. Saturate soil with water when pit or bed is half full of topsoil and again when full.

3.6 PLANT SUPPORT

- A. Brace plants vertically with plant protector wrapped guy wires and stakes to the following:

Tree Caliper	Tree Support Method
1 inch (25 mm)	1 stake with one tie
1 - 2 inches (25 - 50 mm)	2 stakes with two ties
2 - 4 inches (50 - 100 mm)	3 guy wires [with eye bolts and turn buckles]
Over 4 inches (100 mm)	4 guy wires [with eye bolts and turn buckles]

3.7 FIELD QUALITY CONTROL

- A. Plants will be rejected when ball of earth surrounding roots has been disturbed or damaged prior to or during planting.
- B. Only first quality, "A" grade plant material shall be accepted and installed.

END OF SECTION

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SECTION 33 05 13

MANHOLES AND STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Monolithic concrete manholes and structures with masonry transition to cover frame, covers, anchorage, and accessories.
2. Modular precast concrete manhole and structures with tongue-and-groove joints with masonry transition to cover frame, covers, anchorage, and accessories.
3. Bedding and cover materials.

B. Related Sections:

1. Section 03 10 00 - Concrete Forming and Accessories.
2. Section 03 20 00 - Concrete Reinforcing.
3. Section 03 30 00 - Cast-In-Place Concrete:
4. Section 31 05 13 - Soils for Earthwork:
5. Section 31 05 16 - Aggregates for Earthwork
6. Section 31 23 16 - Excavation
7. Section 31 23 23 - Fill

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT – NOT USED

A. American Concrete Institute:

1. ACI 318 - Building Code Requirements for Structural Concrete.
2. ACI 530/530.1 - Building Code Requirements for Masonry Structures and Specifications for Masonry Structures.

B. ASTM International:

1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM C55 - Standard Specification for Concrete Brick.
4. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale).
5. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
6. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
7. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
8. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
9. ASTM D3753 - Standard Specification for Glass-Fiber-Reinforced Polyester Manholes and Wetwells.

C. NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

1.3 DESIGN REQUIREMENTS

A. Equivalent strength: Based on structural design of reinforced concrete as outlined in ACI 318.

B. Design of Lifting Devices for Precast Components: In accordance with ASTM C913.

- C. Design of Joints for Precast Components: In accordance with ASTM C913; maximum leakage of 0.025 gallons per hour per foot of joint at 3 feet of head.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate manhole and structure locations, elevations, piping, conduit, and opening sizes, reinforcement, ladder rung locations, and elevations of penetrations. Generic shop drawings for all structures will not be accepted.
- B. Product Data: Submit cover and frame construction, features, configuration, and dimensions

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
- B. Perform Work in accordance with the project drawings.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years experience.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Comply with precast concrete manufacturer's instructions for unloading, storing and moving precast manholes and structures.
- B. Store precast concrete manholes and structures to prevent damage to Owner's property or other public or private property. Repair property damaged from materials storage.
- C. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

PART 2 - PRODUCTS

2.1 MANHOLES AND STRUCTURES

- A. Manhole and Structure Sections: Reinforced precast concrete in accordance with ASTM C478 with gaskets in accordance with ASTM C923.
- B. Manufacturers to be an approved supplier of materials by the NJDOT

2.2 FRAMES AND COVERS

- A. Furnish materials in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
- B. Product Description: As shown on drawings.

2.3 COMPONENTS

- A. Manhole and Structure Steps: Formed aluminum; 3/4 inch diameter. Formed integral with manhole and structure sections.
- B. Base Pad: Cast-in-place concrete of type specified in Section 03 30 00, leveled top surface.

2.4 CONFIGURATION

- A. Shaft Construction: as indicated on the drawings
- B. Shape: Cylindrical.
- C. Clear Inside Dimensions: as indicated on Drawings.
- D. Design Depth: As indicated on Drawings.
- E. Clear Cover Opening: As indicated on Drawings.
- F. Pipe Entry: Furnish openings as indicated on Drawings.
- G. Steps: As indicated on Drawings.

2.5 BEDDING AND COVER MATERIALS

- A. Bedding: Fill Type as specified in Section 31 05 16 and as shown on drawings.
- B. Cover: Fill Type as specified in Section 31 05 16 and as shown on drawings.
- C. Soil Backfill from Above Pipe to Finish Grade: Soil Type, as specified in Section 31 05 13 Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify items provided by other sections of Work are properly sized and located.
- B. Verify built-in items are in proper location, and ready for roughing into Work.
- C. Verify correct size of manhole and structure excavation.

3.2 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.
- B. Do not install structures where site conditions induce loads exceeding structural capacity of structures.
- C. Inspect precast concrete structures immediately prior to placement in excavation to verify structures are internally clean and free from damage. Remove and replace damaged units.

3.3 INSTALLATION

- A. Excavation and Backfill:
 - 1. Excavate for manholes and structures in accordance with Section 31 23 16 in location and to depth shown. Provide clearance around sidewalls of structure for construction operations.
 - 2. When groundwater is encountered, prevent accumulation of water in excavations. Place manholes and structures in dry trench.
 - 3. Where possibility exists of watertight structure becoming buoyant in flooded excavation, anchor structure to avoid flotation.
- B. Place base pad, trowel top surface level.
- C. Place manhole and structure sections plumb and level, trim to correct elevations, anchor to base pad.
- D. Install manholes and structures supported at proper grade and alignment on crushed stone bedding as shown on Drawings.
- E. Backfill excavations for manholes and structures in accordance with Section 31 23 16 ;31 23 23
- F. Form and place manhole and structures cylinder plumb and level, to correct dimensions and elevations.
- G. Cut and fit for pipe and conduit.
- H. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour to form continuous drainage channel as indicated on Drawings.
- I. Set cover frames and covers level without tipping, to correct elevations.
- J. Coordinate with other sections of Work to provide correct size, shape, and location.

3.4 PRECAST CONCRETE MANHOLE AND STRUCTURE INSTALLATION

- A. Lift precast components at lifting points designated by manufacturer.
- B. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and structure remains clean.
- C. Set precast structures bearing firmly and fully on crushed stone bedding, compacted in accordance with provisions of Section 31 23 16 ;31 23 23 or on other support system shown on Drawings.
- D. Assemble multi-section structures by lowering each section into excavation. Lower, set level, and firmly position base section before placing additional sections.
- E. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.
- F. Joint sealing materials may be installed on site or at manufacturer's plant.
- G. Verify manholes and structures installed satisfy required alignment and grade.

- H. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with mortar.
- I. Cut pipe to finish flush with interior of structure.
- J. Shape inverts through manhole and structures as shown on Drawings.

3.5 FRAME AND COVER INSTALLATION

- A. Set frames using mortar and masonry. Install radially laid concrete brick with 1/4 inch thick vertical joints at inside perimeter. Lay concrete brick in full bed of mortar and completely fill joints. Where more than one course of concrete brick is required, stagger vertical joints.
- B. Set frame and cover 2 inches above finished grade for manholes and structures with covers located within unpaved areas to allow area to be graded away from cover beginning 1 inch below top surface of frame.
- C. Vertical Adjustment of Existing Manholes and Structures:
 - 1. Where required, adjust top elevation of existing manholes and structures to finished grades shown on Drawings.
 - 2. Reset existing frames, grates and covers, carefully removed, cleaned of mortar fragments, to required elevation in accordance with requirements specified for installation of castings.
 - 3. Remove concrete without damaging existing vertical reinforcing bars when removal of existing concrete wall is required. Clean vertical bars of concrete and bend into new concrete top slab or splice to required vertical reinforcement, as indicated Drawings.
 - 4. Clean and apply sand-cement bonding compound on existing concrete surfaces to receive cast-in-place concrete in accordance with Section 03 30 00

3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections for sanitary structures:
 - 1. Vacuum Test (ASTM C1244)
 - 2. Hydrostatic Exfiltration Test: In accordance with manufacturer's instructions.

END OF SECTION

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SECTION 33 05 16

UTILITY STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes precast concrete utility structures:
 - 1. Drainage system catch basins.
 - 2. Drainage system inlets.
 - 3. Drainage system detention structures.
 - 4. Water Meter Pit
 - 5. Frames and covers.

- B. Related Sections:
 - 1. Section 03 10 00 - Concrete Forming and Accessories.
 - 2. Section 03 20 00 - Concrete Reinforcing.
 - 3. Section 03 30 00 - Cast-In-Place Concrete
 - 4. Section 31 23 16 - Excavation
 - 5. Section 31 23 23 - Fill
 - 6. Section 33 31 00 - Sanitary Utility Sewerage Piping:
 - 7. Section 33 41 00 - Storm Utility Drainage Piping:

1.2 REFERENCES

- A. NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

- B. American Association of State Highway Transportation Officials:
 - 1. AASHTO M306 - Drainage Structure Castings.
 - 2. AASHTO S99-HB - Standard Specifications for Highway Bridges.

- C. American Concrete Institute:
 - 1. ACI 318 - Building Code Requirements for Structural Concrete.
 - 2. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
 - 3. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete.

- D. ASTM International:
 - 1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 - 2. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
 - 3. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - 4. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 5. ASTM A185/A185M - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
 - 6. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
 - 7. ASTM A497/A497M - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
 - 8. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

9. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
10. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
11. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
12. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
13. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
14. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
15. ASTM C33 - Standard Specification for Concrete Aggregates.
16. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
17. ASTM C138/C138M - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
18. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
19. ASTM C150 - Standard Specification for Portland Cement.
20. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
21. ASTM C192/C192M - Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
22. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
23. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
24. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
25. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
26. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
27. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
28. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
29. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
30. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Section Precast Concrete Water and Wastewater Structures.
31. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures.
32. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
33. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
34. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
35. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
36. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
37. ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test prior to Backfill.
38. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
39. ASTM C1433 - Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers.

40. ASTM C1504 - Standard Specification for Manufacture of Precast Reinforced Concrete Three-Sided Structures for Culverts, Storm Drains, and Sewers.

E. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.
2. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

F. National Precast Concrete Association:

1. NPCA Quality Control Manual for Precast Plants.
2. NPCA Plant Certification Program.

G. SSPC: The Society for Protective Coatings:

1. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

1.3 SUBMITTALS

A. Shop Drawings:

1. Indicate structure locations, elevations, sections, equipment supports, piping, conduit, sizes and elevations of penetrations, and reinforcement.
2. Shop Drawings shall include structural design and flotation calculations and shall be signed and sealed by a Registered Professional Engineer in the State of New Jersey.

1.4 QUALITY ASSURANCE

A. Obtain precast concrete utility structures from single source.

B. Perform structural design in accordance with ACI 318.

C. Perform Work in accordance with NPCA Quality Control Manual for Precast Plants.

D. Conform to ASTM C913 for material and fabrication requirements

E. Perform welding in accordance with the following:

1. Structural Steel: AWS D1.1.
2. Reinforcing Steel: AWS D1.4.

F. Perform Work in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

G. Perform Work in accordance with project drawings

H. Perform Work in accordance with local utility company standards

1.5 QUALIFICATIONS

A. Manufacturer: Certified by NPCA Plant Certification Program prior to and during Work of this section.

1.6 DELIVERY, STORAGE AND HANDLING

A. Comply with precast concrete manufacturer's instructions for unloading, storing and moving precast structures. Lift structures from designated lifting points.

B. Do not deliver products until concrete has cured 5 days or attained minimum 75 percent of specified 28 day compressive strength.

- C. Store precast concrete structures to prevent damage to Owner's property or other public or private property. Repair property damaged from materials storage.
- D. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

PART 2 - PRODUCTS

2.1 PRECAST CONCRETE UTILITY STRUCTURES

- A. Manufacturers to be an approved supplier by the NJDOT
- B. Furnish materials in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
- C. Precast Concrete Utility Structures: Reinforced precast concrete.
- D. Foundation Slab: as indicated on drawings.

2.2 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I - Normal Portland type.
- B. Fine and Coarse Aggregates: ASTM C33, except gradation requirements do not apply.
- C. Water: Clean and not detrimental to concrete.

2.3 CONCRETE REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, 60 ksi yield grade, plain billet bars, galvanized epoxy coated finish.
- B. Reinforcing Wire:
 - 1. Plain Wire: ASTM A82/A82M; epoxy coated.
 - 2. Deformed Wire: ASTM A496 epoxy coated.
- C. Welded Steel Wire Fabric:
 - 1. Plain Wire: ASTM A185/A185M; unfinished.
 - 2. Deformed Wire: ASTM A497/A497M; unfinished.
- D. Reinforcing Steel Finishes:
 - 1. Galvanized Finish: ASTM A767/A767M, Class I.
 - 2. Epoxy Coating Finish: ASTM A775/A775M.
- E. Wire and Wire Fabric Finishes:
 - 1. Epoxy Coated Finish: ASTM A884/A884M, Class A finish.

2.4 FRAMES AND COVERS

- A. Manufacturers to be approved by the NJDOT
- B. As indicated on project drawings, or approved equal.

- C. Only domestic materials are permitted.
- D. Furnish materials in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

2.5 ACCESSORIES

- A. As indicated on project drawings, or approved equal.
- B. Membrane Curing Compound: ASTM C309 Type 1 Class B.
- C. Steps: Formed aluminum or polypropylene rungs.
 - 1. Diameter: 3/4 inch.
 - 2. Width: 12 inches.
 - 3. Spacing: As indicated on Drawings.
- D. Inserted and Embedded Items:
 - 1. Structural Steel Sections: ASTM A36/A36M; galvanized.
- E. Joint Sealants and Joint Gaskets:
 - 1. Gasket Joints for Circular Concrete Pipe: ASTM C443; standard rubber gaskets.
 - 2. External Sealing Bands: ASTM C877; Type I rubber and mastic bands.
 - 3. Preformed Joint Sealants for Concrete Pipe and Box Sections: ASTM C990.
 - 4. Elastomeric Joint Sealants: ASTM C920; silicone; Grade NS, Class 25; manufactured by.
- F. Pipe Entry Connectors: ASTM C923.
- G. Grout:
 - 1. Cement Grout: Portland cement, sand and water mixture with stiff consistency to suit intended purpose.
 - 2. Non-Shrink Grout: ASTM C1107/C1107M; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days; manufactured by.
- H. Bituminous Coating:
 - 1. Manufacturers:
 - a. Bitumastic
 - b. Beazer East, Inc. .
 - c. Substitutions: Section 01 60 00 - Product Requirements.
- I. Touch-Up Primer for Galvanized Surfaces: SSPC 20 Type II Organic.

2.6 CONCRETE MIX

- A. Select proportions for normal weight concrete in accordance with ACI 318. and ACI 211.1.
- B. Reinforced precast concrete in accordance with ASTM C478 with gaskets in accordance with ASTM C923
- C. Admixtures: Include admixture types and quantities indicated in concrete mix designs approved through submittal process.
 - 1. Do not use calcium chloride.

2.7 FABRICATION

- A. Fabricate precast concrete utility structures in accordance with ACI 318 and NPCA Quality Control Manual for Precast Plants.
- B. Fabricate precast concrete utility structures to size, configuration, knock out panels, and openings as indicated on Drawings.
- C. Construct forms to provide uniform precast concrete units with consistent dimensions.
- D. Clean forms after each use.
- E. Install reinforcing by tying or welding to form rigid assemblies. Position reinforcing to maintain minimum 1/2 inch cover. Secure reinforcement to prevent displacement when placing concrete.
- F. Position and secure embedded items to prevent displacement when placing concrete.
- G. Deposit concrete in forms. Consolidate concrete without segregating aggregate.
- H. Provide initial curing by retaining moisture using one of the following methods:
 - 1. Cover with polyethylene sheets.
 - 2. Cover with burlap or other absorptive material and keep continually moist.
 - 3. Apply curing compound in accordance with manufacturer's instructions.
- I. Provide final curing in accordance with manufacturer's standard.
- J. Remove forms without damaging concrete.

2.8 CONCRETE FINISHES

- A. Formed Surfaces Not Exposed to View: As formed.
- B. Unformed Surfaces: Finish with vibrating screed or hand float.
 - 1. Permitted: Color variations, minor indentations, chips, and spalls.
 - 2. Not Permitted: Major imperfections, honeycomb, or other defects.
- C. Exposed to View Finishes: Troweled light broom

2.9 SOURCE QUALITY CONTROL

- A. Visually inspect completed precast structures for defects.
 - 1. Repair defects affecting exposed to view surfaces to achieve uniform appearance.
 - 2. Repair honeycomb by removing loose material and applying grout to produce smooth surface flush with adjacent surface.
 - 3. Repair major defects only when permitted by Architect/Engineer.
- B. Make test results available to Architect/Engineer upon request.

2.10 FINISHING - STEEL

- A. Galvanizing: ASTM A123/A123M; hot dip galvanize after fabrication.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify items provided by other sections of Work are properly sized and located.
- B. Verify correct size and elevation of excavation.
- C. Verify subgrade and bedding is properly prepared, compacted and ready to receive Work of this section.

3.2 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.
- B. Do not install structures where site conditions induce loads exceeding structural capacity of structures.
- C. Inspect precast concrete structures immediately prior to placement in excavation to verify are internally clean and free from damage. Remove and replace damaged units.

3.3 INSTALLATION

- A. Install underground precast utility structures in accordance with ASTM C891.
- B. Lift precast concrete structures at lifting points designated by manufacturer.
- C. When lowering structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and structure remains clean.
- D. Install precast concrete base to elevation and alignment indicated on Drawings.
- E. Install cast-in-place concrete foundation slab (if designated on plans) in accordance with Section 03 30 00, trowel top surface level.
- F. Install precast concrete utility structures to elevation and alignment indicated on Drawings.
- G. Assemble multi-section structures by lowering each section into excavation.
 - 1. Clean joint surfaces.
 - 2. Install watertight joint seals in accordance with manufacturer's instructions using gasket joints, or.
- H. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with grout.
- I. Connect pipe to structure and seal watertight. Cut pipe flush with interior of structure.
- J. Grout base to achieve slope to exit piping. Trowel smooth. Contour as indicated on Drawings.
- K. Set frame and cover and access hatch level without tipping, to elevations indicated on Drawings.
 - 1. Set cover 2 inches above finished grade for structures located within unpaved areas to allow area to be graded away from cover beginning 1 inch below top surface of frame.
- L. Touch up damaged galvanized coatings.

- M. Backfill excavations for structures in accordance with Section 31 23 23.
- N. Install Work in accordance with project drawings and NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

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SECTION 33 11 16

SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings for site water line including domestic water line and fire water line.
2. Valves.
3. Positive displacement meters.
4. Backflow preventers.
5. Underground pipe markers.
6. Bedding and cover materials.

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete
2. Section 31 05 13 - Soils for Earthwork
3. Section 31 05 16 - Aggregates for Earthwork
4. Section 31 23 16 - Excavation
5. Section 31 23 17 - Trenching
6. Section 31 23 23 - Fill

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT – NOT USED

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Society of Mechanical Engineers:

1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

C. American Society of Sanitary Engineering:

1. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent.
2. ASSE 1013 - Reduced Pressure Principle Backflow Preventers.

D. ASTM International:

1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
2. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
3. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures.
4. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
5. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
6. ASTM D1785 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
7. ASTM D2241 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.

8. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
9. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
10. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
11. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
12. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
13. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

E. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:

1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
5. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
6. AWWA C502 - Dry-Barrel Fire Hydrants.
7. AWWA C504 - Rubber-Sealed Butterfly Valves.
8. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in. (50 mm) Through 24 in. (600 mm) NPS.
9. AWWA C509 - Resilient-Seated Gate Valves for Water-Supply Service.
10. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
11. AWWA C606 - Grooved and Shouldered Joints.
12. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
13. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
14. AWWA C702 - Cold-Water Meters - Compound Type.
15. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
16. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.
17. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.
18. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

G. Underwriters Laboratories Inc.:

1. UL 246 - Hydrants for Fire - Protection Service.

H. NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

1.4 SUBMITTALS

- A. Product Data: Submit data on pipe materials, pipe fittings, valves and accessories. Submittals are subject to review and approval by local utility company.

1.5 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. Perform Work in accordance with local utility company standards.
- C. Perform Work in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.1 WATER PIPING

- A. Ductile Iron Pipe: AWWA C151:C104:C150; double cement-mortar lined and seal coated in accordance with AWWA C104
 - 1. Fittings: AWWA C110 Ductile iron, standard thickness.
 - 2. Joints: AWWA C111, rubber gasket with rods.
 - 3. Jackets: AWWA C105 polyethylene jacket].
- B. Flange Adapter: Ebav Iron Inc Series 2100 Megaflange Restrained Flange Adapter, or approved equal
- C. Furnish materials in accordance with local utility company standards

2.2 GATE VALVES

- A. Manufacturer – Mueller 2360 Series Resilient Wedge Gate Valve, or approved equal
- B. Furnish materials in accordance with local utility company standards.

2.3 CHECK VALVES

- A. Manufacturer – Watts Series 709 Double Check Valve Assembly
- B. Furnish materials in accordance with local utility company standards

2.4 METERS

- A. Manufacturer – Nepture Technology Group High Performance Protectus II Fire Service Meter, or approved equal.
- B. Furnish materials in accordance with local utility company standards

2.5 UNDERGROUND PIPE MARKERS

- A. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.6 BEDDING AND COVER MATERIALS

- A. Bedding: Coarse Aggregate Fill as specified in Section 31 05 16.
- B. Cover: Coarse Aggregate Fill, as specified in Section 31 05 16
- C. Soil Backfill from Above Pipe to Finish Grade: Soil Type as specified in Section 31 05 13. Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

2.7 ACCESSORIES

- A. Concrete for Thrust Restraints: Minimum 3,500 psi Concrete

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify building service connection and municipal utility water main size, location, and invert are as indicated on Drawings.

3.2 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

3.3 BEDDING

- A. Excavate pipe trench in accordance with Section 31 23 17 for Work of this Section.
- B. Form and place concrete for pipe thrust restraints at change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide thrust restraint bearing on subsoil.
- C. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth; compact to 95 percent.
- D. Backfill around sides and to top of pipe in accordance with Section 31 23 23.
- E. Maintain optimum moisture content of fill material to attain required compaction density.
- F. Place fill material in accordance with Section 31 23 23.

3.4 INSTALLATION - PIPE

- A. Maintain separation of water main from sewer and water piping in accordance with NJDEP standards.
- B. Install ductile iron piping and fittings to AWWA C600.
- C. Route pipe in straight line.

- D. Install pipe to allow for expansion and contraction without stressing pipe or joints.
 - E. Install access fittings to permit disinfection of water system performed under Section 33 13 00
 - F. Form and place concrete for thrust restraints at each elbow or change of direction of pipe main.
 - G. Establish elevations of buried piping with not less than 4 ft of cover.
 - H. Install plastic ribbon tape continuous over top of pipe buried 6 inches below finish grade, above pipe line; coordinate with Section 31 23 23 ;31 23 17
 - I. Backfill trench in accordance with Section 31 23 23
 - J. Install Work in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended and local utility company standards.
- 3.5 INSTALLATION - VALVES AND HYDRANTS
- A. Set valves on solid bearing compacted soil.
 - B. Center and plumb valve box over valve. Set box cover flush with finished grade.
 - C. Install Work in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended, and local utility company standards.
- 3.6 INSTALLATION - METERS
- A. Install Work in accordance with local utility company standards.
- 3.7 SERVICE CONNECTIONS
- A. Install water service in accordance with local utility company requirements.
 - B. Install water service to 5 feet of building. Connect to building water service.
 - C. Install Work in accordance with local utility company standards.
- 3.8 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM
- A. Flush and disinfect system in accordance with local utility company standards
- 3.9 FIELD QUALITY CONTROL
- A. Pressure test system in accordance with AWWA C600 and the following:
 1. Test Pressure: Not less than 200 psi ([1380 kPa]) or 50 psi ([345 kPa]) in excess of maximum static pressure, whichever is greater.
 2. Conduct hydrostatic test for at least two-hour duration.
 3. Fill section to be tested with water slowly, expel air from piping at high points. Install corporation cocks at high points. Close air vents and corporation cocks after air is expelled. Raise pressure to specified test pressure.
 4. Observe joints, fittings and valves under test. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage. Retest.

5. Correct visible deficiencies and continue testing at same test pressure for additional 2 hours to determine leakage rate. Maintain pressure within plus or minus 5.0 psig (34.4 kPa) of test pressure. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
6. Compute maximum allowable leakage by the following formula:

$L = (SD\sqrt{P})/C$
L = testing allowance, in gallons per hour (liters per hour)
S = length of pipe tested, in feet (meters)
D = nominal diameter of pipe, in inches (mm)
P = average test pressure during hydrostatic test, in psig (kPa)
C = 148,000 (794,797)
When pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

7. When test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections and retest until leakage is within allowable limits. Correct visible leaks regardless of quantity of leakage.
- B. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

END OF SECTION

SECTION 33 31 00

SANITARY UTILITY SEWERAGE PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sanitary sewage pipe.
2. Underground pipe markers.
3. Bedding and cover materials.

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete
2. Section 31 05 13 - Soils for Earthwork
3. Section 31 05 16 - Aggregates for Earthwork
4. Section 31 23 16 - Excavation
5. Section 31 23 17 - Trenching
6. Section 31 23 23 - Fill

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT – NOT USED

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
2. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
3. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
4. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
5. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
6. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
7. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
8. ASTM D1785 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
9. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
10. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
11. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
12. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.

13. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
14. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
15. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
16. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
17. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
18. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
19. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

D. Local Utility Company Standards

1.4 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.5 SUBMITTALS

A. Product Data: Submit data indicating pipe material used, pipe accessories, and cleanouts.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record location of pipe runs, connections, manholes, cleanouts, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with the Local Utility Company standards.

1.8 FIELD MEASUREMENTS

A. Verify field measurements and elevations are as indicated on drawings.

1.9 COORDINATION

A. Coordinate the Work with termination of sanitary sewer connection outside building, connection to municipal sewer utility service, and trenching.

PART 2 - PRODUCTS

2.1 SANITARY SEWAGE PIPE

- A. Plastic Pipe: ASTM D3034, SDR 35, Poly (Vinyl Chloride) (PVC) material; inside nominal diameter as specified on the plans, bell and spigot style rubber ring sealed gasket joint.
 - 1. Fittings: PVC.
 - 2. Joints: ASTM F477, elastomeric gaskets.

2.2 UNDERGROUND PIPE MARKERS

- A. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.3 MANHOLES

- A. Manholes as specified in Section 33 05 13

2.4 BEDDING AND COVER MATERIALS

- A. Bedding: As indicated on the project drawings and as specified in Section 31 05 16.
- B. Cover: As indicated on the project drawings and as specified in Section 31 05 16.
- C. Soil Backfill from Above Pipe to Finish Grade: Soil Type, as specified in Section 31 05 13. Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify trench cut and excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.2 PREPARATION

- A. Correct over excavation with coarse aggregate.
- B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

3.3 BEDDING

- A. Excavate pipe trench in accordance with Section 31 23 17.
- B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with ASTM D2321. Seal joints watertight.
- B. Lay pipe to slope gradients noted on drawings; with maximum variation from indicated slope of 1/8 inch in 10 feet.
- C. Install bedding at sides and over top of pipe to minimum compacted thickness of 12 inches.
- D. Refer to Section 31 23 17 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.
- E. Connect to building sanitary sewer outlet and municipal sewer system
- F. Install plastic ribbon tape continuous over top of pipe buried 6 inches below finish grade coordinate with Section 31 23 23, 31 23 17.
- G. Install site sanitary sewage system piping to 5 feet of building. Connect to building sanitary waste system. Refer to Section 22 13 00.
- H. Install Work in accordance with local utility company standards.

3.5 INSTALLATION - MANHOLES

- A. Install Work in accordance with local utility company standards and NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

3.6 FIELD QUALITY CONTROL

- A. Perform test on site sanitary sewage system in accordance with local utility company standards.
- B. Request inspection prior to and immediately after placing bedding.
- C. When tests indicate Work does not meet specified requirements, remove work, replace and retest.

3.7 PROTECTION OF FINISHED WORK

- A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Storm drainage piping.
 - 2. Accessories.
 - 3. Underground pipe markers.
 - 4. Catch basins and plant area drains.
 - 5. Cleanouts.
 - 6. Bedding and cover materials.

- B. Related Sections:
 - 1. Section 03 30 00 - Cast-In-Place Concrete
 - 2. Section 31 05 13 - Soils for Earthwork
 - 3. Section 31 05 16 - Aggregates for Earthwork
 - 4. Section 31 23 16 - Excavation
 - 5. Section 31 23 17 - Trenching
 - 6. Section 31 23 23 - Fill
 - 7. Section 33 05 13 - Manholes and Structures.

1.2 UNIT PRICE - BASIS OF MEASUREMENT – NOT USED

1.3 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

- B. ASTM International:
 - 1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
 - 2. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
 - 3. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 - 4. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
 - 5. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
 - 6. ASTM C924 - Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
 - 7. ASTM C969 - Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
 - 8. ASTM C1103 - Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
 - 9. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 10. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 11. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

12. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
13. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
14. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
15. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
16. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
17. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
18. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
19. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
20. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

1.4 SUBMITTALS

- A. Product Data: Submit data indicating pipe, pipe accessories, reinforcement, and manufacturer
- B. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.
- C. Manufacturer's Certificate: Certify Products meet or exceed NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents:
 1. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
- B. Verify all existing storm utility inverts and finished grades prior to starting work.
- C. Perform work in accordance with the Project Drawings

1.7 PRE-INSTALLATION MEETINGS

- A. Convene minimum one week prior to commencing work of this section.

1.8 COORDINATION

- A. Coordinate the Work with termination of storm sewer connection outside building, trenching, connection to municipal stormwater collection system.

PART 2 - PRODUCTS

2.1 STORM DRAINAGE PIPING

- A. Plastic Pipe: Polyethylene Culvert Pipe: AASHTO M294, smooth interior.
 - 1. Joints: Polyethylene sleeve with gasket
- B. Reinforced Concrete Pipe: ASTM C76 , Class III and Class V with mesh reinforcement; inside nominal diameter as specified on the project drawings, bell and spigot ends.
- C. Joints: ASTM C443, rubber compression gasket.

2.2 ACCESSORIES

- A. Grout: Specified in Section 03 30 00

2.3 CATCH BASINS, YARD DRAINS, AND CLEANOUTS

- A. Furnish materials in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
- B. Furnish materials as specified on the project drawings, or approved equal.

2.4 BEDDING AND COVER MATERIALS

- A. Bedding: As shown on the project drawings and as specified in Section 31 05 16
- B. Cover: As shown on the project drawings and as specified in Section 31 05 16.
- C. Soil Backfill from Above Pipe to Finish Grade: Soil Type, as specified in Section 31 05 13 general fill with no rocks over 6 inches in diameter, frozen earth or foreign matter.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify trench cut; excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with coarse aggregate lean concrete.
- B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

- A. Excavate pipe trench in accordance with Section 31 23 17 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth.

- C. Maintain optimum moisture content of bedding material to attain required compaction density.
- 3.4 INSTALLATION - PIPE
- A. Refer to Section 31 23 23 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.
 - B. Refer to Section 33 05 13 for manhole requirements.
 - C. Install Work in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
 - D. Install site storm drainage system piping to 5 feet of building. Connect to building storm drainage system.
- 3.5 INSTALLATION - CATCH BASINS AND CLEANOUTS
- A. Form bottom of excavation clean and smooth to correct elevation.
 - B. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.
 - C. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.
 - D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.
 - E. Install Work in accordance with NJDOT Standard Specifications for Road and Bridge Construction, 2007, as amended.
- 3.6 FIELD QUALITY CONTROL
- A. Request inspection prior to and immediately after placing aggregate cover over pipe.
 - B. Compaction Testing: In accordance with ASTM D1557, ASTM D698, AASHTO T180, ASTM D2922, ASTM D3017.
 - C. When tests indicate work does not meet specified requirements, remove work, replace and retest.
- 3.7 PROTECTION OF FINISHED WORK
- A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
 - 1. Take care not to damage or displace installed pipe and joints during construction of pipe supports, backfilling, testing, and other operations.
 - 2. Repair or replace pipe that is damaged or displaced from construction operations.

END OF SECTION